

80

microcomputing^{T.M.}
the magazine for TRS-80* users

Assault on BASIC

The continuing search
for better ways to communicate
with your computer.

Inside:

80 examines
the business
microcomputer
and what it can
do for you.



Percom Mini-Disk Drive Systems for TRS-80* Computers...

Now! Add-On and Add-In Mini-Disk Storage for your Model III.



The industry leader in microcomputer peripherals, Percom not only gives you better design, better quality and first-rate service, but you pay less to boot.

Still #1 for Model I

As if greater storage capacities, exceptional quality control measures and lower prices aren't reasons enough to make Percom your first choice for Model I add-on drives, all Percom Model I drives are also rated for double-density operation.

Add our innovative DOUBLER™ adapter to your Model I Expansion Interface, and with Percom drive systems you can enjoy the same double-density storage capability as Model III owners.

The DOUBLER includes a TRSDOS*-like double-density disk operating system called DBLDOS™.

We also offer a double-density Model I version of OS-80 as well as DOUBLEZAP programs for modifying NEWDOS/80 and VTOS 4.0† for DOUBLER compatibility.

Of course you don't have to upgrade your computer for double-density operation to use Percom mini-disk drive systems. In single-density operation, our TRS-80* Model I compatible 40-track drives store 102 Kbytes of formatted data on one side of a diskette, and our 80-track drives store 205 Kbytes. By comparison, Tandy's standard drive for the Model I stores just 86 Kbytes.

And like our Model III drives, Model I add-on drives are optionally available with "flippy" storage capability.

System Requirements:

Model III: 16-Kbyte system (min) and Model III BASIC. The second internal drive may be installed after the first internal drive kit is installed, and external drives #2, #3 and #4 may be added if either an internal or external first-drive kit has been installed. External drives #3 and #4 require an optional interconnecting cable.

Model I: 16-Kbyte system (min), Level II BASIC, Expansion Interface, disk operating system and an interconnecting cable. For double-density storage, a Percom DOUBLER must be installed in the Expansion Interface and DBLDOS (comes with the DOUBLER) or other double-density DOS must be used. For single-density operation, a Percom SEPARATOR™ adapter, installed in the Expansion Interface, will virtually eliminate "CRC ERROR — TRACK LOCKED OUT" read errors. Prices and specifications subject to change without notice.

New for the TRS-80* Model III

Patterned after our fast-selling TFD Model I drives. And subjected to the same reliability controls. These new TFD mini-disk systems for the Model III provide more features than Tandy drives, yet cost far less.

- **Flippy Capability:** Both internal (add-in) and external (add-on) drives permit recording on either side of a diskette.
- **Greater Storage Capacity:** Available with either 40- or 80-track drive mechanisms, Percom TFD mini-disk systems store more. A 40-track drive stores up to 180 Kbytes — formatted — on one side of a 5-inch diskette. An 80-track drive stores a whopping 364 Kbytes.
- **1.5 Mbyte On-line:** The Percom drive controller (included with the initial drive) handles up to four drives. With four 80-track mini-disk drives you can access over 1.5 million bytes of on-line file data.

Moreover, the initial drive may be either an internal add-in drive or an external add-on drive. And whichever configuration you get, the initial drive kit comes complete with our advanced 4-drive controller, interconnecting cables, power supplies, installation hardware, a DOS and of course the drive mechanism itself.

- **First Drive Includes DOS:** OS-80™, Percom's fast extendable BASIC-language disk operating system, is included on diskette when you purchase an initial drive kit. Originally called MicroDOS, OS-80 was favorably reviewed in the June 1980 issue of Creative Computing magazine.
- **Works with Model III TRSDOS:** Besides being fully hardware compatible, Percom's Model III 40-track drive systems may be operated with Tandy's Model III TRSDOS — without any modifications whatsoever. And, TRSDOS may be easily upgraded with simple software patches for operating 80-track drives.

Percom TFD add-on drives start at only \$399. Model III Drive kits start at only \$749.95.

Quality Percom products are available at authorized dealers. Call toll free 1-800-527-1592 for the address of your nearest dealer or to order direct from Percom.

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

✓ 408

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†Trademark of Virtual Technology Corporation.

TRS-80* COMPUTING EDITION

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The Percom Peripheral

35 cents

Percom's DOUBLER II* tolerates wide variations in media, drives

GARLAND, TEXAS — May 22, 1981 — Harold Mauch, president of Percom Data Company, announced here today that an improved version of the Company's innovative DOUBLER* adapter, a double-density plug-in module for TRS-80* Model I computers, is now available.

Reflecting design refinements based on both theoretical analyses and field testing, the DOUBLER II*, so named, permits even greater tolerance in variations among media and drives than the previous design.

Like the original DOUBLER, the DOUBLER II plugs into the drive controller IC socket of a TRS-80 Model I Expansion Interface and permits a user to run either single- or double-density diskettes on a Model I.

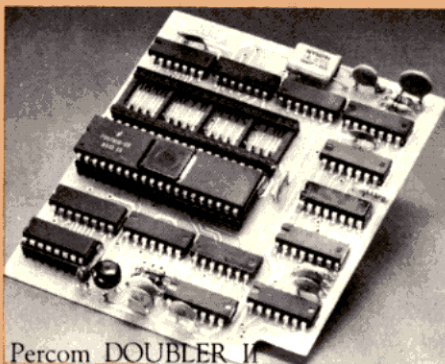
With a DOUBLER II installed, over four times more formatted data — as much as 364 Kbytes — can be stored on one side of a five-inch diskette than can be stored using a standard Tandy Model I drive system.

Moreover, a DOUBLER II equips a Model I with the hardware required to run Model III diskettes.

(Ed. Note: See "OS-80": Bridging the TRS-80* software compatibility gap* elsewhere on this page.)

The critical clock-data separation circuitry of the DOUBLER II is a proprietary design called a ROM-programmed digital phase-lock loop data separator.

According to Mauch, this design is more tolerant of differences from diskette to diskette and drive to drive, and also provides immunity to performance degradation caused by circuit component aging.



Mauch said "A DOUBLER II will operate just as reliably two years after it is installed as it will two days after installation."

The digital phase-lock loop also eliminates the need for trimmer adjustments typical of analog phase-lock loop circuits.

"You plug in a Percom DOUBLER II and then forget it," he said.

The DOUBLER II also features a refined Write Precompensation circuit that more effectively minimizes the phenomena of bit- and peak-shifting, a reliability-impairing characteristic of magnetic data recording.

The DOUBLER II, which is fully software compatible with the previous DOUBLER, is supplied with DBLDOS*, a TRSDOS* compatible disk operating system.

The DOUBLER II sells for \$29.95, including the DBLDOS diskette.

~~\$29.95~~
Now \$169.95!

Owners of original DOUBLERs may purchase a DOUBLER II upgrade kit, without the disk controller IC, for \$30.00. Proof of purchase of an original DOUBLER is required, and each DOUBLER owner may purchase only one DOUBLER II at the \$30.00 price.

The Percom DOUBLER II is available from authorized Percom retailers, or may be ordered direct from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty.

All that glitters is not gold OS-80* Bridging the TRS-80* software compatibility gap

Compatibility between TRS-80* Model I diskettes and the new Model III is about as genuine as a gold-plated lead Kruggerand.

True, Model I TRSDOS* diskettes can be read on a Model III. But first they must be converted and re-recorded for Model III operation.

And you cannot write to a Model I TRSDOS* diskette. Not with a Model III. You cannot add a file. Delete a file. Or in any way modify a Model I TRSDOS diskette with a Model III computer.

Furthermore, your converted TRSDOS diskettes cannot be converted back for Model I operation.

TRSDOS is a one-way street. And there's no retreating. A point to consider before switching the company's payroll to your new Model III.

Real software compatibility should allow the direct, immediate interchangeability of Model I and Model III diskettes. No read-only limitations, no conversion/re-recording steps and no chance to be left high and dry with Model III diskettes that can't be run on a Model I.

What's the answer? The answer is Percom's OS-80* family of TRS-80 disk operating systems.

OS-80 programs allow direct, immediate interchangeability of Model I and Model III diskettes.

You can run Model I single-density diskettes on a Model III; install Percom's plug-in DOUBLER* adapter in your Model I, and you can run double-density Model III diskettes on a Model I.

There's no conversion, no re-recording.

Slip an OS-80 diskette out of your Model I and insert it directly in a Model III.

And vice-versa.

Just have the correct OS-80 disk operating system — OS-80, OS-80D or OS-80/III — in each computer.

Moreover, with OS-80 systems, you can add, delete, and update files. You can read and write diskettes regardless of the system of origin.

OS-80 is the original Percom TRS-80 DOS for BASIC programmers.

Even OS-80 utilities are written in BASIC.

OS-80 is the Percom system about which a user wrote, in Creative Computing magazine, "... the best \$30.00 you will ever spend."

Requiring only seven Kbytes of memory, OS-80 disk operating systems reside completely in RAM. There's no need to dedicate a drive exclusively for a system diskette.

And, unlike TRSDOS, you can work at the track sector level, defining and controlling data formats — in BASIC — to create simple or complex data structures that execute more quickly than TRSDOS files.

The Percom OS-80 DOS supports single-density operation of the Model I computer — price is \$29.95; the OS-80D supports double-density operation of Model I computers equipped with a DOUBLER or DOUBLER II; and, OS-80/III — for the Model III of course — supports both single- and double-density operation. OS-80D and OS-80/III each sell for \$49.95.

Circuit misapplication causes diskette read, format problems. High resolution key to reliable data separation

GARLAND, TEXAS — The Percom SEPARATOR* does very well for the Radio Shack TRS-80* Model I computer what the Tandy disk controller does poorly at best: reliably separates clock and data signals during disk-read operations.

Unreliable data-clock separation causes format verification failures and repeated read retries.

CRC ERROR-TRACK LOCKED OUT

The problem is most severe on high-number (high-density) inner file tracks.

As reported earlier, the clock-data separation problem was traced by Percom to misapplication of the internal separator of the 1771 drive controller IC used in the Model I.

The Percom Separator substitutes a high-resolution digital data separator circuit, one which operates at 16 megahertz, for the low-resolution one-megahertz circuit of the Tandy design.

Separator circuits that operate at lower frequencies — for example, two- or four-

megahertz — were found by Percom to provide only marginally improved performance over the original Tandy circuit.

The Percom solution is a simple adapter that plugs into the drive controller of the Expansion Interface (EI).

Not a kit — some vendors supply an untested separator kit of resistors, ICs and other paraphernalia that may be installed by modifying the computer — the Percom SEPARATOR is a fully assembled, fully tested plug-in module.

Installation involves merely plugging the SEPARATOR into the Model I EI disk controller chip socket, and plugging the controller chip into a socket on the SEPARATOR.

The SEPARATOR, which sells for only \$29.95, may be purchased from authorized Percom retailers or ordered directly from the factory. The factory toll-free order number is 1-800-527-1592.

Ed. note: Opening the TRS-80 Expansion Interface may void the Tandy limited 90-day warranty.

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PRICES DO NOT INCLUDE HANDLING AND SHIPPING.

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Language Quest '81

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by G. Michael Vose

You know there's some way to talk to a computer, but you're not sure what it is. Somewhere there's got to be a computer that understands you. Probably not, but don't worry—Vose provides a roadmap to the ways computers talk, and the languages they speak.



COBOL—Ready and Waiting

116

by Robert L. Bradley

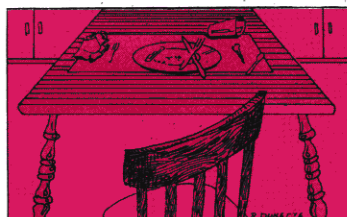
COBOL is a computer language for businessmen, commonly used, and one of the few which have been standardized. It used to be available only on mainframes—now you can have it on your '80.

Pilot—The Language of Computer Aided Instruction

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by Randy Hawkins

Pilot is the language of computer aided instruction, the language of students—simple, short, and infinitely patient. You can put Pilot in your '80; here's how, with suggestions for its use.



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by David Busch

The debut of a new column from Kitchen Table Software describes the kind of utilities you only dream about. Get ready to giggle.

Microcomputers—Business or Pleasure

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by Bert Latamore

80 examines the future of microcomputing in business. Ed Juge fences some industry strategists whose opinions differ on growth and dollars in the next decade. You'll find out how three businessmen are defying the pessimists using their 80's in the office today.

COMING NEXT MONTH

The August issue of *80* is our annual games issue. Wile away the summer with this *80* games sampler. Our roving journalist/gamesman, Bert Latamore, shares some industry plans with you. In case the games prove too much for you (or your rpg character), there's a program that will help you generate a custom-designed will.

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DOSPLUS

FEATURES:

- 1) Radio Shack compatibility
- 2) Error free variable length records
- 3) Full lower case detection and support
- 4) Repeating keyboard with NO keybounce EVER
- 5) Shift [0] typewriter keyboard option
- 6) Execute only protection feature for BASIC programs
- 7) Automatic track support for 35 through 80 track drives (mixed)
- 8) Device I/O handling with FORCE command
- 9) Supports high speed clock modification (up to 4.0mhz)
- 10) Supports mixed mode (single & double density) automatically
- 11) Allows disable-enable of break key
- 12) Allows user to define step rate per drive and re-configure system disk
- 13) Allows for efficient use of double-headed drives
- 14) Built in screen printer (shift [CLEAR]) with [BREAK] key abort
- 15) Multiple command chaining with "DO"
- 16) Built in memory test with CLEAR command
- 17) New printer driver which allows complete forms control and paging
- 18) Automatic serial printer driver with optional auto linefeed
- 19) Execute any DOS command from BASIC and return to BASIC
- 20) Free space map of diskette with optional output to printer
- 21) Copy with variable length files
- 22) Complete RS232 control from keyboard with status check
- 23) Create and pre-allocate files from DOS
- 24) Display current date and time from DOS
- 25) More information from Directory with optional printer output
- 26) Enter DEBUG with shift [BREAK] to allow use of [BREAK] from BASIC
- 27) New DISKDUMP/CMD sector display/modify program (works with filespecs)
- 28) New DISKZAP/CMD single/double density disk editor
- 29) New BACKUP (more reliable, no more pack ID check)
- 30) New FORMAT (more reliable, no need to bulk erase disk first)
- 31) New MAP utility (maps out disk, showing where files are located)

New DOSPLUS Z80 Extended Disk BASIC

- 1) Faster loads and saves
- 2) BASIC Reference utility (lines, variables, keywords, printer option)
- 3) BASIC Renumber utility (renumber section of text, block text move)
- 4) Shorthand features for almost ANY direct command (LOAD, SAVE, etc.)
- 5) Shorthand features for editing (listing and editing with single key)
- 6) CMD "M" instantly displays currently set variables
- 7) Global search and replace in BASIC text
- 8) Line printer TAB to 255
- 9) OPEN "E" to end of sequential file (for output)
- 10) DI (delete and insert text line)
- 11) DU (duplicate text line)
- 12) ".R" & ".V" options after LOAD and RUN (files open & save variables)
- 13) OPEN "D" allowed (Model II compatible) equal to OPEN "R"
- 14) DOS commands from BASIC
- 15) Automatic, error-free variable length records
- 16) Single step execution with TRON (fabulous for debugging)
- 17) CRUNCH (BASIC program compressor)
- 18) New TBASIC (tiny BASIC) offers full BASIC commands
- 19) TBASIC and DOSPLUS together only use 8K of RAM (40K left in 48K TRS-80)

***** 7 MORE UTILITIES *****

- 1) Single drive copy
- 2) Restore (dead files)
- 3) Purge (unwanted files)
- 4) Clearfile (destroys data by writing zeros to file)
- 5) Transfer (moves all user files from one disk to another)
- 6) Spooler (allows printing of text while freeing up the CPU)
- 7) Crunch (Basic program compressor)

***** ALSO *****

- New I/O package 30% faster
- No BREAK key death from DOS
- No closing killed files and ruining diskettes

DOSPLUS gives you more of what you buy an operating system for. Speed and reliability without sacrificing simplicity and power. If you need extra power without extra wait, then you need DOSPLUS!

Single or double density systems available for Model I. Model III DOSPLUS ready for immediate delivery.

Perhaps the best investment you can make for your TRS-80! Listen to what others have had to say about DOSPLUS.

"Overall, DOSPLUS is the fastest operating system I have seen..."

Pete Carr in 80-US Journal.

"DOSPLUS...the better mousetrap."

Stewart Fason in 80-Microcomputing

"On a scale of 1 to 10, I give DOSPLUS a solid 9."

Reese Fowler in 80-Microcomputing
(Model III DOSPLUS review)

For the BASIC programmer, our features are unmatched. For the average businessman, our speed and simplicity cannot be beat.

So, join the satisfied users who have joined DOSPLUS. Experience excellence! Experience DOSPLUS!

DOSPLUS comes complete with full utilities, PLUS a FREE patch to enable Model I Scripsit/Super Script to run on Model III, UNLIMITED Backups!

Model I DOSPLUS — \$99⁹⁵

Model III DOSPLUS — \$99⁹⁵

Model I double density upgrade — \$175⁰⁰

Master Directory 1.2 (double density) — \$29⁹⁵

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DOS BUGS!!
ORDER TODAY!!**



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80 REMARKS

by Wayne Green

*"We need a flexible language
mated to that hardware...
without (it), software
development moves very slowly."*

Where Are The Business Programs?

I'm constantly running into people who have written a program to help with some business chore, but who have never thought about brushing it up for publication. Yet, it could be exactly what newcomers to computers are looking for. Useful business programs don't end with accounting and word processing. These are important programs, but in the long run every business needs specific applications software. Schools need programs to keep track of students, grades and schedules. Cities and towns need software to keep track of residents, voting lists, property evaluations, taxes and licenses—hunting, fishing and driving.

With this huge need for software, why are there so few programs available for business use in computer stores? The answer is complex.

Three fundamental items are needed before we can produce sophisticated business software. First we need a reasonably good hardware system, sold in enough quantity to support software development, and which will be around for a while. We have that in the TRS-80.

Next we need a flexible language mated to that hardware: we have this in Microsoft BASIC. Without a high level language, software development moves very slowly.

Finally, we need a good disk operating system. We have had our best DOS systems for the TRS-80 for only about a year. I'm talking particularly of NEWDOS+ and DOSPLUS. Thus, in practical terms, programmers have had the tools they need for only about a year. Since complicated programs can take weeks or even months to write, and far longer to debug, is it any wonder we are just now beginning to see some really first rate business programs emerging?

Further, there is the major problem of Radio Shack being uncooperative with outside suppliers of products for the TRS-80. If you try to deal with Radio Shack you need a barrage of lawyers and an extremely sharp business manager. And,

even if you've written a good program, it can take them years to make a decision.

If you decide to go to an independent publisher, you still have to watch your step; too few have a reputation for being honest with programmers. Fewer still have the distribution facilities necessary to see that your program is advertised properly and distributed to enough computer stores to earn you significant royalties.

One answer is the large-scale program publishing house...such as Instant Software. Yes, I'm biased—Instant Software is a division of Wayne Green, Inc. Keep that in mind as you read the following.

The Marketplace

A couple of years ago I sensed the importance of business programs as a way

*"With this huge need
for software, why
are there so few
programs available...?"*

to help computer stores sell systems. Yet, the Instant Software group has not been able to publish anywhere near the number of business programs they would like to. However, the number of good business programs submitted has been increasing in recent weeks.

Now, to put in a word for Instant Software. It does take quite a while to get a program published there, but this is important to you. Customers and dealers alike have been ripped off by poor quality software; Instant Software takes the time to carefully evaluate every submission. From over 10,000 programs submitted for publication during the last three years, only about 1,000 have been okayed for production.

If you don't have the experience in

some business field to write the needed programs, get together with someone who does. Not only will specialized applications programs sell well, in many cases they can bring about an equipment sale. I believe that the more good programs we have, the more computers will be sold.

For this reason it's unfortunate that Radio Shack has been so reluctant to cooperate with program publishers. Instant Software has been trying to distribute programs through Radio Shack stores for over two years without success. I feel that they have everything to win and little to lose by stocking more programs in their stores. Radio Shack's philosophy is to sell only high volume programs. That merchandising philosophy prohibits their even considering handling slower selling but specialized programs. Pity...and an opportunity for some other firm to meet the needs of the market.

Instant Software has had considerable success reaching the Radio Shack franchise stores and these store owners tell us repeatedly that our programs are a key to many of their sales.

Instant Software plans to maintain a library of several thousand programs. For now, most will be sold through computer stores, but with technology evolving the time may come when it will no longer be necessary for a store to carry an inventory of programs. We may eventually be able to load them via telephone or even by satellite.

By the way, Instant Software's looking for more sales reps for several areas of the country, to handle software, books, magazines, and even some advertising sales. If you have sales experience and are interested in working with a fast growing firm, let me know.

What To Do

After you've written your business program, debug it. Then, do the best you can writing documentation. Put as much of the documentation as possible into the program, so people like me who hate to read instructions will be able to blunder through it with ease. Then, submit it to a top-notch software publisher of your choice.■

INSIDE 80

by Ed Juge, director of
computer merchandising, Tandy Radio Shack

*"We're aware of the difficulty
some of you have had in getting
through... we've recently
expanded the staff..."*

This month completes my first full year of Inside 80. It's been fun, and I'm thankful every month hasn't been quite like this one. I'm writing this in early May, a time when bad weather is traditional in Texas. Anyway, I had left this writing for the weekend. Friday night high winds, rain, and hail hit the Fort Worth/Dallas area. Our electricity went off at 11 p.m. Friday, and remained off for just over 20 hours. Needless to say, Scripsit and I didn't get together.

Finally, I was able to get started. I cranked out Inside 80, and was about to repaginate and print it, so I could get on with some other homework. During repagination, I got a disk I/O error, and was never able to recover any of the text. Fortunately, my Scripsit disks are all backed up periodically, so that one file was all that was lost.

Pocket Computer News

This month, we're introducing an exciting add-on for the TRS-80 Pocket Computer—a printer with built-in cassette interface! It uses plain paper one and three fourths inches wide, and a cartridge ribbon. It prints 16 characters per line, at 60 lines per minute, and it responds to Print and List commands, when the print switch is on. Power comes from built-in rechargeable batteries, with a charger included.

*"... in early May... bad
weather is traditional
in Texas... high winds,
rain and hail hit..."*

You'll get about 8,000 lines of printing on a single battery charge! Also, so you won't have to carry so many pieces along with you, the printer also contains a cassette interface. It's the most often requested item to go with the Pocket Computer, and

it's available now for only \$149.

You're probably thinking that if you knew about the printer while the Pocket Computer sale was on in May, you'd have bought one. Well, don't worry. We've announced a new low everyday price on the pocket computer, \$229. Now you can enjoy a complete system at a good price.

During the coming months, I'll have some news for Color Computer and Model II owners. At this point, I hesitate to hint what it might be, because of the chastising mail I get talking about products before you can actually buy them.

I would like to encourage your comments on what subjects you'd like me to cover in this column. Would you like to hear about new products, in-depth product information, bugs and fixes, insight into our thinking and actions, or...? Let me hear from you!

Computer Services (Hot Line) Expanded

Routine questions are being answered by our Computer Services group. Frankly, the merchandising team is too limited to be able to reply to those kind of questions and still bring you products.

We're aware of the difficulty some of you have had in getting through to our Computer Services group. In an effort to relieve the problem, we've recently expanded the staff from 32 to about 45 people. Since the first of the year, we've also added another 15 WATS lines, bringing the total to 41.

There have also been many requests for specific telephone numbers for business software questions. They are:

Model I/III	
Business Software.....	1-800-433-5641
In Texas.....	1-800-772-5973
Model II	
Business Software.....	1-800-433-5640
In Texas.....	1-800-772-5972
All other calls.....	1-800-433-1679
In Texas.....	1-800-772-5914

The new Business Software numbers are set up to be answered directly by a service representative, not by a receptionist. Those folks are specialists, and probably won't be able to answer any questions not related to their specific responsibilities,

so don't just keep trying numbers until you get an answer. Call the proper number.

To get information to you quicker, Computer Services asks that you have the following information on hand when you place the call:

- 1) Your name
- 2) Your phone number
- 3) What TRS-80 computer system you're using, and the number of disk drives, etc.
- 4) The name and catalog number of the software package you're using and the version number of the software if you know it.
- 5) What error codes you've received.
- 6) How the error occurred, and the function you were executing when it occurred.
- 7) Information about any patches or program corrections you may have made.

If you have this information for us the whole system should function much more effectively. I'd also like to recommend that when the phone is answered, you ask who you're talking to. Write the name down, so you can refer back to the same person later, if you need to.

Software Progress

You might be interested to know that during March and April we began shipping 16 new software packages, and released 11 more, most of which will be shipped in May. (Color Computer ROM packs take much longer, of course). Among them were a couple of educational packages for the Models I and III; our long-awaited Medical Office System for 48K, four-drive Mod I/III; our first three-disk Model II accounting package including Accounts Receivable, and the Model II Mailing List II which interacts with Profile to produce personalized form letters. We've also shipped a program called Reformatter, which allows the Model II with at least two drives and 64K RAM to transfer files be-

Continued to p. 36

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"If you set a transistor radio near the keyboard, an astonishing range of sound effects may be heard... from train whistles to birdcalls."

Paper Tiger Graphics

Bob Boothe's "Advanced Graphics Techniques—Part 2" (May, 1981) is a quality article that makes *80 Microcomputing* many times worth its cover price.

A few simple changes to the assembly language program make it compatible with the IDS Paper Tiger. Since the Paper Tiger looks only for the six least significant bits (0–5), each byte of the storage area should never contain a value higher than 63. This means more memory is required and more lines are needed to get a complete printout.

What young Mr. Boothe has given us are true hi-res vector graphics. Many plotter routines may be simply converted to the indicated format. The printouts obtained are something that will show those skeptics just what your TRS-80 can do!

One note: If you set a transistor radio near the keyboard, an astonishing range of sound effects may be heard as the program runs—everything from train whistles to bird calls!

I anxiously await Part 3 of the series.

Dan Rollins
Azusa, CA

Micronet: 70250,631

Computing Misfit

Though "A Field Guide to Computerists" (May, 1981) was a funny and interesting article, I feel it brought up one problem about the image of a kid in computers. I am 14, and have been programming for a little more than two years. Besides myself, nobody in my family knows anything about computers, so most of what I know came from experimenting and many accidental and non-accidental discoveries. In my two years, I have learned BASIC and assembly language. I recently sold programs to *CLOAD* magazine. I've mastered S-80 sound. I can make sound effects superior to all the sound I've heard in the past. I'd discovered text strings long before the many articles about them came out. I know a hundred POKes and other tricks on my S-80 that have it doing some

interesting things. I've even found a high resolution graphics trick for a 384 x 192 display, through software and no hardware. Some call me a Whiz Kid on computers.

Only one problem: I don't wear plaid pants and shirt, as "A Field Guide To Computerists" suggests. I wear Levi's and an OP shirt. I don't have a "plastic shirt pocket protector containing an inordinate amount of pencils." And my TI-30 calculator stays home, rather than with me in a leather calculator pouch. I quote from the article, "Don't try to find the whiz kid at sporting events, or at discos; try the local computer store or library instead." Well, I happen to love watching basketball and football, and even more, I like to play them. I play tennis all the time. True, I won't be found at a disco, because you know what they say, "Disco is dead, but rock is rolling." Rock is much better than disco. On occasion, I do stop by a computer store to buy something, but you'd be wasting your time looking for me there, because I'm usually not. I hate reading, except of course reading *80 Microcomputing*.

So I don't fit the image of a Whiz Kid. And I'm sure that there are other kids who don't, but are quick on the computer. By this stereotype, we can't be Whiz Kids. Do I have to dress differently, act differently, and think differently before I can become a Whiz Kid?

Ron Goodman
North Hollywood, CA

Micro 'Master Teachers'

I read with interest *80 Remarks* in the May edition of *80 Microcomputing*. As an educator and computer hobbyist I agree that the microcomputer may be one of the most important innovations happening in today's education environment. However, before the microcomputer is accepted by the better teachers and administrators, I see a great need for the makers of the programs to involve the "master teachers" in subject/content aid. I see too many good programs (from a computer program sense) with poor educational methodolo-

gy. As the computer industry starts making programs for the more subjective curriculum (history, political science, language arts), you must begin to recruit some non-computer "master teachers" to aid the cause!!

Brian James, Media Specialist
Winston Churchill High School
Eugene, OR

Descending Sort Program

Once again Mr. Barden has come to my rescue with his assembly language bubble sort in the April, 1981, issue. Please keep up the good work.

Some readers might be interested to know that changing one particular byte of the sort program can cause it to sort in a descending rather than an ascending order.

To implement the change, replace location 7F52 with F2; originally it was FA.

Peter Gibbs
University of the West Indies
Bridgetown, Barbados

Erase First

I purchased a Percom TFD-100 disk drive for my TRS-80 in July, 1980. One of the reasons I purchased this particular drive was because of the claim that the drive would read and write to both sides of a diskette, thus increasing potential storage to 204K for a diskette.

I have never had any problems with the drive since it arrived, except for one small glitch: I couldn't get the drive to write to Side B of a diskette! I tried nearly everything I could think of to get that drive to write to Side B, but it totally refused. Finally, after fiddling with this for quite awhile, I simply put the matter out of my mind, figuring it would come to me someday.

One afternoon I committed the cardinal disk drive sin: I shut off the drive with a disk in it. I zipped up to Radio Shack and purchased a bulk eraser, came back home and erased the disk, front and back. I put

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Address Aid

With reference to the inquiry form A. E. Kazee in your May issue, about CRTs made by Clinton Manufacturing: The company is Clinton Electronics Corp., 6701 Clinton Rd., Rockford, IL 61111, telephone (815) 633-1444. They have a sales office in Vista, CA, at 1764 Kent Place, telephone (714) 758-3160.

A 12-inch Clinton CRT designed for a Motorola monitor is available, new with documentation, for \$38.97 from Technical Electronics, P.O. Box 2361, Woburn, MA 01888, telephone (617) 935-7328. This is Clinton Part No. CE394—M12P39TE15, with 90° deflection and a 7-pin octal base. I do not know if this is a replacement for the Radio Shack CRT, nor the color of the phosphor.

*G. F. McClure
1730 Shiloh Lane
Winter Park, FL 32789*

Low-cost Component Interface

I just discovered Mr. Mike Bloom's letter in your February issue. I am faced with the very same problem: I use a Model I, Level II, 48K, and a MIN printer. I used it for some time in 110 bauds, then discovered how to get something reliable at 300 bauds, but it is still very slow.

Where and how could I buy the two-component interface for less than \$75?

*Marie-Claude Weber
23 Rue P. Brossolette
F 93500
Pantin, France*

Eliminate Memory Waste

Like Joe Brandiner (April 1981), I use a BASIC software driver to operate my printer. However, I rarely have any reason to print lowercase material other than from Scripsit. I did notice that the program bombed the one time

I tried, but I didn't make the connection until I read Joe's letter.

My printer is a Dynatyper from Rochester Data. It is a little slow, but it gives excellent copy on an electric office typewriter. It uses BASIC to POKE a driver program into high memory when I want to use the LLIST or LPRINT commands. Since my system has 48K, I reserve memory at 65280 before POKEing the 256-byte program.

Sure enough, ULCBAS destroys the driver program. After rebooting, I tried answering the memory size question with 28672, which is the starting address for ULCBAS. Everything worked fine, but this approach is grossly wasteful of memory.

With the data from page 4 of the ULCBAS booklet, I rebooted the system and answered the memory size question with 64500 (an easy number to remember). From available data, it appeared that I needed only 815 bytes. By changing one number in my driver program, I relocated it between 64511 and 64743, leaving 729 bytes for ULCBAS. This is still wasteful of memory, but it made changing the driver program easier: $150\ P = 4 \cdot (P + 16) - 1$ to $P = 4 \cdot (P + 16) - 4$.

Finally, I used a PEEK/LPRINT program to obtain a copy of the combined programs. The ULCBAS program was relocated just below the protected memory. The driver program was easily identified just above protected memory, followed by a new program that has little resemblance to the original ULCBAS program. I'm not sure I understand what happened, but it works, and I hope it will solve Joe's problem.

Now maybe someone can solve my problem. I have some machine language programs, including In-Memory Information, that give a "printer not ready" message, since I am using a non-standard printer connected to the TRS-80 bus. I would like to know how to defeat these printer signals or alter the programs.

*Scott Smith
2919 26th Ave. West
Seattle, WA 98199*

Tab Solution

I have noted many people trying to find solutions to the LPRINT TAB(63+) problem. The solution that I received from Fort Worth over two years ago (and forgotten by them) is the following:

```
STRINGS(T - PEEK(16539),32)
T = tab setting
Sample: LPRINTSTRINGS(40 - PEEK(16539),32)
"40";STRINGS(80 - PEEK(16539),32)"100"
```

All items tabbed as above will appear in the same column. I even used it to tab to 162 with an IBM Selectric. I use this for all my programs and have had no trouble at all.

*Lou Wiener
20776 W. Plum Cyn. Road
Saugus, CA 91350*

English Aid

I am interested in software applications in Life Insurance, Training Management Games and Computer Assisted Training. I would appreciate any information anyone has on programs, research, or contacts from the United States with similar interests.

*A. E. Sheil
Refuge Assurance
Oxford St.
Manchester, M60 7HA
England*

Hi-Res Graphics Games

I'm looking for hi-res graphical games for the TRS-80 Level II 16K. They could be run on the following products: Percom's Electric Crayon, Programma's 80-Grafix Board, and E/RAM.

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David Wareham, Vice President (EDP), National Hospital and Health Care Services Inc.

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Jack Bilinski, President, 80 Microcomputer Services

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Frank Boehm, Director, Front Door Residential Treatment Program

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the disk back in the drive, reformatted it, and, purely by chance, pulled it out, flipped it over, and tried to format Side B. Imagine my utter astonishment when it worked!

I immediately took a blank, never-before-used disk and erased both sides and formatted it. Again, it worked. Since that day, I have always first erased the new diskette, and I have never had an ounce of trouble reading or writing to both Side A and Side B.

I'm happy to report that I'm finally getting my 204K's worth of storage.

Michael K. Salsgiver
Portland, OR

RSM-2 for Model III

This short note may be of interest to new Model III owners who have Model I experience. I, as many others, have found that Small System Software's RSM-2 monitor is a very valuable tool for debugging and otherwise studying software problems. Small System Software is working on a version for the Model III, but the release date is unknown. However, a cassette tape version of RSM-2, or RSM-2D, will load and execute many of RSM's functions in a Model III. Since the Model III is a port-based system, whereas the Model I is memory mapped for everything but cassette, the printer and disk operations have been changed. Also, the difference in baud rates means that RSM-2 cannot read or write the 500-baud tapes on the Model III, and likewise that the Model III System command cannot read tapes written by RSM-2 on a Model III.

However, there is a simple way to alleviate this problem using RSM-2 itself. All you need to do is change four memory locations using the RSM-2 edit command:

Address	Change	From	To
6CBD	81	92	
6CC7	0F	11	
6CCF	0F	11	
6CD7	60	6C	

These addresses are for a 16K version of RSM-2. For a 32K version the addresses are 4000 (hex) larger, that is, they begin with A, and in a 48K system they begin with E. The last three digits are the same for all three sets of numbers. These values reflect the faster clock rate in the Model III. With the memory changed, you can now use RSM-2's P command to write a system tape that will save the changes. You will find that you will have to start and stop the cassette yourself, as that is also done differently by the Model III. Never-

theless, this simple change will let you have most of the features of RSM for a Model III until Small System Software releases the complete package.

Maynard B. Neher
Columbus, OH

Software Incompatibility

After many, many moons of waiting, including numerous periods of total frustration, I finally received our first piece of Radio Shack software specifically written for the new Model III: Scripsit (cassette version).

Anyone who has tried knows that the older Model I version (regardless of what RS advertising or storepersons state) will load but not work... and we spent considerable time and long-distance phone calls, not to mention repeated trips to no less than three RS Computer Centers, trying to separate the "fly-specks from the pepper", so we were understandably quite elated when our tape finally arrived from Fort Worth. (We finally went direct to solve our problem... and I must admit, the Computer Services people were great!!!)

Much to our delight, the program is a gem! Everything works! We were, however, surprised to find the cassette manufactured to load at the low 500 baud speed instead of the newer 1500 baud capability inherent in the Model III. And in investigating why, I was advised by Radio Shack at Fort Worth that they: "Do not plan to support the 1500 baud cassette rate with any of the RS software created for the Model III."

Is Radio Shack telling me that the single-most valuable difference (for us non-diskers) between the Model I and III is not going to be utilized? I'd sure like Mr. Juge or one of his people to address this small question. One could almost start believing this is RS's not-too-subtle way of getting me to buy a disk!!!

Larry M. Mohr
Design Systems
Kankakee, IL

Radio Shack Replies

80 Microcomputing has forwarded your recent letter to me, regarding your complaint on our Model III software. I'm sorry you had the problem you had, and I'm pleased that Computer Services was able to help. I'll be happy to address your question.

First of all, let me assure you that we do intend to support the 1500 baud Model III

tape format. Your tape was created before we had generated the 1500 baud version of the in-house software we use to verify cassettes. Rather than take a chance, we produced them at 500 baud.

Our November 1980 newsletter dealt very thoroughly with Model III program compatibility, detailing which programs will and which won't work, as does a sheet shipped with each Model III (which I must assume you didn't receive). We specified those requiring modification, and those (including Scripsit) for which a Model III specific version would be required. I believe some 20 percent of Model I software turned out to be not compatible or need modification or revision.

We regret the incompatibilities that were necessary between Models I and III. Our hope had been total compatibility, but we weren't designing a "warmed-over" Model I, we were trying for an enhanced and improved computer. Some concessions were unavoidable. We've also invested considerable time and expense upgrading existing warehouse stocks of Model I programs as Model III compatible versions have become available.

Ed Juge, Director
Computer Merchandising
Tandy-Radio Shack
Fort Worth, TX

Disk BASIC Adaptation

I just finished the article "A Turn of the Screw" in the April 1981 80 Microcomputing.

After typing in and attempting to run program seven on page 123, I found that it would not work with TRSDOS BASIC and a 48K machine.

After some debugging I added an additional line to the program (245 DEFUSR=&HFE53) so it would work under Disk BASIC.

The hex address in the above might have to be changed for different size systems. It's used on my 48K machine.

The program listed in the magazine works fine with Level II BASIC.

Richard P. Stiles
Windsor, CT

Know-It-All?

Alan Sehmer's VARDOC2 ("Know-It-All", May 1981) is a super program, albeit (as he admits) rather slow. I'm not sure whether I did something wrong, but I couldn't get it to work until I changed line

Continued on page 19



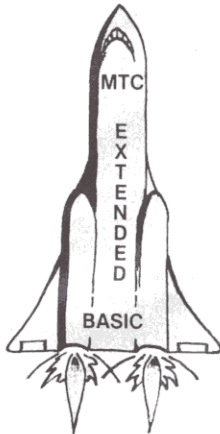
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80 DEBUG

Babydub Flub

It was bound to happen. Total incompatibility, and my mailbox shows it. Babydub, March, 1981, just won't work on machines which have the Radio Shack cassette modification installed, or which are running under just about any DOS. These improved tape loaders are more stern with their timing than the original CLOAD routine. The timing after the synchronization byte is just a few microseconds too fast for it to catch, so a delay must be inserted in the program. Okay, so make the five changes below:

```

LINE 10:  CHANGE 20701 TO 20711.
LINE 90:  CHANGE THE 8TH DATA ITEM FROM
          208 TO 218.
LINE 100: CHANGE THE 2ND DATA ITEM FROM
          179 TO 189.
LINE 170: CHANGE THE 7TH DATA ITEM FROM
          193 TO 203.
LINE 200: AFTER THE 3RD DATA ITEM (WHICH IS
          79), ADD THESE TEN ITEMS:
          245,197,1,32,0,205,96,0,193,241

```

If you're entering the hexadecimal version, change byte 4301 from B3 to BD; byte 4376 from C1 to CB; and starting at 43A3, insert these ten bytes: F5 C5 01 20 00 CD 60 00 C1 F1. Move the remainder of the program along ten places.

Also, high-memory freaks should note that you can't relocate this program to high memory without crashing it. Why? Because it reads the tape information into memory starting at 7FFF and filling memory backwards. If you relocate it to high memory, it will wipe itself out within seconds.

Dennis Kitsz
Roxbury, VT 05669

Disk Error

There are several potential problems with the program listed in my article "Sans Disks" (April 1981).

1. When using the Select If, Change If, or Delete If commands, don't use spaces just before or after the =, >, <, or <> symbols. That will cause errors.

For example:

```

SELECT IF NAME = JONES      Is wrong.
SELECT IF NAME = JONES      Is correct.

```

2. When records are being entered, there is no indication when memory is full. To correct this add the following lines:

```

305 IF(D2 + (F2 - 1)) < 32767 THEN 310
308 D2 = D2 - 1: IF PEEK(D2) < > 2 THEN 308 ELSE
      POKE D2 + 1,5: PRINT "MEMORY IS FULL":
      GOTO 360

```

With 16K memory use 32767 in line 305. With 32K, use - 16385 and with 48K, use - 1.

3. The program was written only for 16K memory. For 32K or 48K make the changes to the lines indicated in Listing 1.

Stewart F. Hunter
15510 Murray Hill
Detroit, MI 48227

Wherzit Fixit

I am the proud owner of a TRS-80 Model III. Since I'm also a novice to microcomputing, I have difficulty spotting bugs in my programs. Having en-

tered the "Wherzit" program on page 252 of the April issue, I discovered, much to my dismay, that not only was line 83 missing entirely, but also that the delete (/) function was incomplete as printed.

Any time a record is deleted from storage, it is duplicated at the end of the file and the first record disappears. Line 69 is the offending line in the program. To remedy the situation, I have added this statement at the beginning of line 69: R\$(N) = R\$(1).

It sets the first record in the file equal to the Nth record, thereby protecting it from oblivion (when the rest of the line alters the file record sequence).

The duplicate of the deleted record is not saved to tape and is over-written by any subsequent record additions. Line 83, as I constructed it, reads: 83 N = N + S: GOTO 63.

Another typo is the omission of a semicolon at the end of line 64 before A\$(8).

Colin Alexander
120-28th St.
San Francisco, CA 94131

Continued to page 20

```

94  DATA0,58,224,116,254,1,202,10,117,33,1,128,205,132,2,126,35,205,100,2,254,4,194,239,116,33,
    232,131,126,35,205,100,2,254,5,194,252,116,205,248,1,201,205,147,2,33,1,128,205,53,2,119,
    35,254,4,194,16,117,33,232,131,205,53,2,119,35,254,5,194
127  D1 = - 32767
235  D1 = - 32767: D2 = - 31767
330  IF PEEK(D1) = 4 THEN D1 = - 32767: POKE D2,2: D2 = D2 + 1: PRINT: GOTO 240
500  D1 = - 32767: D2 = - 31767
640  D1 = - 32767: CT = 0
660  D2 = - 31768
705  DST = - 31767
805  D1 = - 32767
900  D1 = - 32767: FOR I = - 31767 TO - 16386: IF PEEK(I) < > 5 NEXT: ELSE 905
910  X = 29610: Y = INT(X/256): Z = X - (Y * 256): POKE 16526, Z: POKE 16527, Y: H$ = MID$(COS$, 9, 244):
    D1 = - 31767: CT = 0: GOSUB 9800
925  RP = - 31767: S = 0
9102 D5 = D1: D1 = - 32767: GOSUB 9200: GOSUB 3000: M$ = F1$: GOSUB 9600: M$ = " ":
    GOSUB 9600
9800 C = 0: F1(0) = 0: FOR I = - 32767 TO - 31768: IF PEEK(I) = 4 THEN 9810
9810 S = C/20: D3 = - 32767: FOR I = 1 TO S: D3 = D3 + 16
9903 IF CT = 1 THEN D9 = D2: I1 = 1: GOTO 9906
9906 IF D9 < 0 THEN D9 = D9 + 65536

```

Listing 1. Sans Disks Corrections

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65095 to read:

```
65095 ... ELSE IF C$<A$(J) THEN 65125 (not
C$>A$(J)).
```

Also, the readout was in reverse alphabetical order until I changed line 65160 to read:

```
65160 FOR R=A1 TO 1 STEP -1: LE= ... etc.
```

A change in 65085 will tell whether arrays are single or multi-dimensional:

```
65085 IF T=40 AND (PEEK(F+2)=44 OR PEEK(F+3)=
44 OR PEEK(F+4)=44) AND PEEK(F+2)<>41 AND
PEEK(F+3)<>41 THEN C$=C$+"(##)" ELSE IF
T=40 THEN C$=C$+"(##)"
```

*Richard R. Losch
Salem, MA*

Small Business Needs

Your publication regularly asks for articles by businessmen on their use of small computers. I know next to nothing about them, but I do have a complete Radio Shack Model II System installed in my small business and thought that a letter would suffice as input from a typical user.

We are a small manufacturer of photographic equipment, with about 20 employees and sales of a little under \$1 million.

Our system includes the 64K computer, an expansion drive and the Line Printer III. We use all standard Radio Shack software including general ledger, payroll, accounts receivable, accounts payable, mailing list and profile.

After using this system for just about a year, we feel quite comfortable with it and accept the fact that off-the-shelf will never be more than 80 percent of what you might want. However, that is an acceptable compromise. Our problems have generally centered around repeated disk failures which were finally solved by switching to Verbatim disks. In our application at least, these seem to be the most dependable.

While those who write the programs are undoubtedly much smarter than I am, they seem to know little about the routine needs of business. For example, programs such as accounts receivable and accounts payable simply must have a mailing list option where you can easily print out customer names and addresses on standard mailing labels. Every business has to send out price announcements, special promotions, notification of vacation closings, etc. It is frustrating to have to type out all of the customer or vendor names and addresses when these are already in the computer. In short, those suppliers who intend to provide accounts receivable and accounts payable programs for the small businessman must incorporate an address label option with

80AID

screen with the TRS-80 Level II 16K. It also includes eight different colors. It costs \$249.95.

Programma's 80-Grafix Board gives you hi-res graphics using a 384 x 192 pixel screen; it's in black and white. I don't recommend this product because it goes inside the keyboard, and that would cancel Radio Shack's guarantee.

E/RAM gives you the same graphics as the Electric Crayon, but no color. I think it is priced too high for its performance. It costs \$349.95.

I have been reading your magazine for about four months now and haven't seen any programs except for the hi-res add-ons. It really is a shame that the TRS-80 can have better graphics than the Apple II+, or almost as good, and there aren't any programs out for them. I want to see that changed. By having hi-res programs for the TRS-80 there will be more people buying the TRS-80, this magazine, the products above, and software in hi-res.

The TRS-80 may have the most games out on the market, but it's time for a change in TRS-80 gaming. TRS-80 owners could stand high and proud knowing they have the best home computer on the market. The United States needs a home computer like this to keep us ahead of the Japanese market. The TRS-80 can be that computer and more with your help.

*Sean Hockabout
210 Ironwood Road
Alameda, CA 94501*

Sean tells us he's 13 years old.-Eds.

Computerese

I would appreciate any information concerning a computer program reported in *Computer Power For The Small Business*, by Charles J. Sippl and Fred Dahl and published by Prentiss-Hall, page 156, developed by Mr. Ashok Nagrani and called "SPREG."

Quote from the book:

You might become so proficient at programming that you will come up with a program as clever

and as daring as that of Mr. Ashok Nagrani who invented SPREG. Using Altair's Extended BASIC version 3.2, he composed a program that would spout "Computerese," a language very similar to that used by politicians, diplomats, and double talkers who find themselves pressed for an honest answer. Drawing on a data base of nouns, verbs, adjectives, and other parts of speech, the program structures them in a way that is grammatically correct (well, almost) but essentially meaningless. The beauty of the program is that it can generate up to a trillion such meaningless sentences without ever repeating itself.

If you have any information concerning the above we would appreciate your notifying us.

*Sam W. Allred, Administrator
Capitol Home Health Agency
307-A Clinton Blvd.
Clinton, MS 39056*

On First Command

After having read so much about KBEEFIX I was delighted to find the disk version featured in the March issue. Since the article stated this particular version was identical to the original, save for a couple of minor code changes, I found it easy enough to modify so that it should be the same as the original. I deleted the first five bytes, changed the jump in 7F95 to jump to 1A19 (BASIC's starting point) and changed the instruction in location 7F91 to 7F, as I have a 16K system.

When I loaded the T-BUG-created system tape and tried it out, I found I got all the benefits claimed. However, I have to issue a New or Clear as my first command, or I will get an OM error on entering any other command as my first command. My question is whether this is normal, or a problem with my RAM or program. Although the problem is minor and easily circumvented, it is still an irritation. Any help you can give me would be appreciated.

Lastly, I would like to see more articles on assembly programming, especially articles dealing with uses of ROM routines.

*Bernard F. Gaffney Jr.
524 Riley St.
Lansing, MI 48910*

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their software.

Another thing that is annoying, although less so, is that the basic menu formats and operating procedures will differ substantially for different programs from the same supplier (Radio Shack). On one program you type in the password and you see it on the screen. On another program you type in the password and all you get is a series of number signs so that someone viewing the screen can't see the password. It would be a lot easier if the programs were consistent so that an operator wouldn't have to follow different procedures for different programs. Similarly, on some programs you use the Break key and on other programs this would court disaster. Again, if these programs were from different manufacturers it would be understandable, but coming from the same source they should be similar.

Finally, when printing out several reports, an option that lets you initialize the accounts receivable program and indicate which type of paper or form should be used would be a nice touch. If you could put in a 10 or 12-letter identifier next to each report on the menu, the operator would immediately know whether to use three-part paper, invoices, labels, etc.

Steven Hess
President, Saunders Photo/Graphic
Rochester, NY

Backup Change

I found the article "Backup/Display" by Craig Lindley in the May 1980 issue very useful, but had some difficulty with the printout part, because I have the official Radio Shack lowercase modification.

When the transfer is made from the video memory, I lose all the alphabetic characters. After some experimenting, I found that the alphabetic characters are stored on the screen in the range 00-1F hex, so the trick is to add 40H to all characters below 20H as they are brought from the screen.

The following changes to the code in the article should correct things:

1. Change line 1400 to read:
1400 LDATA LD A,(HL)
2. Add lines 1402-1408 as follows:
1402 CP 20H
1404 JR NC,GT20H
1406 ADD A,40H
1408 GT20H LD C,A

After this change, I had no further problems, and I am now busy making backup copies of all my programs.

George Rogers
St. Laurent du Var, France

80 DEBUg

Cursor Correction

In my article "Block That Cursor" (April, 1981), it seems that the Tab function doesn't work with the block cursor running.

Fortunately, the fix is as easy as swapping a couple numbers around in the data statement. The first five numbers of line 50 should read as follows:

50 DATA 205,88,4,245,197—all the rest are the same.

An updated listing to the program with the corrections made follows.

Ron Balewski
412 E. Ridge St.
Nanticoke, PA 18634

```
1 REM ***** BLOCK CURSOR PATCH
2 REM BY RONALD A. BALEWSKI
10 FORK = 32635TO32654
20 READX
30 POKEK,X
40 NEXTK
50 DATA205,88,4,245,197,237,75,32,64,10,
    254,95,32,3,62,143,2,193,241,201
60 POKE16414,123
70 POKE16415,127
```

Block That Cursor Correction

Ledger Tape

A number of readers have experienced trouble making the initial run of my program, "The General Ledger" (page 222, May, 1981). The program is designed to run with a data tape, but if a blank tape is used as a data tape "FD Error in 3000" will be displayed.

To make a suitable data tape with zero balances in the various accounts the following procedure may be used:

1. Enter the program.
2. Place a blank cassette in the recorder and set it to record.
3. Key in: RUN 620, and Enter.
4. Press Enter again. The recorder will then record the various accounts with zero balances. This

tape may then be used as a data tape to run the program initially.

If the user wishes to start entering account data without making a zero balance data tape, he can load the program and enter: RUN 220. This data can then be recorded after a trial balance of the new data has been run.

Also note that a number has been left off in line 1340 of the published program. The end of the line should read: If X = 1 GOTO 130.

R. L. Conhaim
15506 Kiamichi Road
Apt. 1
Apple Valley, CA 92307

Car Error

One of your readers has found an error in my article, "The Auto Mentor," in the May 1981 issue. The error is in lines 1220 and 1230. The correct lines are:

```
1220 X1 = DR - (X(21)/12/100) :EFFECTIVE RATE
    FOR OLD CAR FUEL
1230 X2 = DR - (X(22)/12/100) :EFFECTIVE RATE
    FOR NEW CAR FUEL
```

The time to replace the old car in the example with these changes is 49 months.

Leslie E. Sparks
1014 Evergreen Drive
Durham, NC 27712

Once Again

The "80 Input" department of your April issue published a comment from me with a fix for the chi square program of the Radio Shack Advanced Statistical Analysis package. Unfortunately, some of those pesky parentheses in the fix were not typeset accurately, so the correction won't work.

The proper version of the fix for the last statement in line 280 is: CS = CS + (ABS(O(I,J) - E(I,J)) - CC)*2/E(I,J).

Alfred L. Brophy, Ph.D.
Director, Guidance Exchange
421 Mackenzie Drive
West Chester, PA 19380

THE ALPHA I/O SYSTEM

A COMPLETE FAILURE?

It happened 3 years ago, when our President made a decision. At the time we specialized in custom analog and digital circuit design. The decision was to attempt to develop a line of standard interface hardware for the emerging microcomputers. At the time (1977) we had to decide which of the new machines could become the "industry standard" of the low cost micros.

Despite a few aggravating but minor deficiencies, the TRS-80 seemed to have the most chance of success and it had the best price/performance ratio. Also, with some imagination, their large sales organization could become the largest service network in the world, a reassuring thought for the many novices in this new field.

It became clear that the TRS-80 could be used (with our then hypothetical system) to solve problems in many fields where computers were not yet used, mostly because of their high cost.

The IDEA was simple! ALPHA PRODUCT would supply the missing link between the TRS-80 and the "outside world", (more about this "outside world" later).

DANGER! If Radio-Shack entered the same market, we probably would not have survived, but the expectation was that they would be too busy developing their basic line (drives, printers, modem etc.). Thanks to our more specialized products, we would not be competing with them.

BAD START! We began with a failure. Our first product was supposed to be a simple, low cost, general purpose device. It would allow the TRS-80 to accept inputs other than the keyboard. Many kinds of external devices (the "outside world" mentioned before) like photocells, sensors, thermostats, switches, contacts, etc., could be connected easily. In addition, there were two relays to control (on or off) external loads such as motors, lamps, appliances, heaters, etc., etc. In other words, it would allow the computer to interact or interface with external devices. We called it the INTERFACER 2. What a mistake! It sounded too much like "expansion interface". Many enthusiastic TRS-80 users called thinking that our "INTERFACER 2" was a low cost Expansion Interface (at \$85 that would have been a real bargain!). We wanted to change the confusing name. That meant reprinting the manual, changing the ad, scrapping the flyers, discarding the silk screened cases. Well, "INTERFACER 2" it would stay.

TROUBLE! We also found that the majority of TRS-80 users were AFRAID of the hardware. They could be very comfortable with fancy programming but thought you had to be a computer specialist or technically inclined to put the INTERFACER 2 to work. In truth, some IMAGINATION and a SCREWDRIVER is all you really need. Anyone able to wire a switch could use this device.

WORSE! There was also the fear of plugging a "foreign device" into the precious computer. This notion has all but disappeared as there are now so many quality products designed for the TRS-80 that plugging in a non Radio-Shack device has become common.

Our ad in Creative Computing (80-Microcomputing did not yet exist) hardly paid for itself.

We had a decision to make. Were we wrong or just too early? Our first INTERFACER 2 was sold to someone who wanted to, and succeeded in, controlling his fancy model railroad with his TRS-80. Interesting, but what made us stick with the concept was that some of our INTERFACERS began finding use in applications with fascinating possibilities. Space is lacking to describe them, but the most exciting was the successful use of the system in assisting a handicapped young boy. We were pleased to hear of such a meaningful application.

Three years later, as you can see in our ads, The INTERFACER 2 is alive and well. The price went up a bit, and despite the introduction of the more powerful INTERFACER 80, the sales have been steady.

Then came the least understood product! the ANALOG 80. This \$139, nicely designed module is an Analog to Digital converter with 8 input channels. Used with your TRS-80, it provides a powerful "data acquisition system". This jargon simply means that you can monitor, measure and record 8 independent varying voltages. Very few people realized its real power. Such a system would have cost over ten thousand dollars just a few years ago.

The possibilities in scientific and engineering environments are endless. This system could replace chart recorders, digital data recorders, programmable calculators, data analyzers and many other specialized and expensive pieces of equipment. Furthermore, up to 8 ANALOG 80's could be used simultaneously for a total of 64 channels of analog input! They simply plug into the TRS-80 using our "X" series of bus extenders (EXPANDABUS).

Our next product was to be a second generation, Input/Output interface, with more flexibility than the INTERFACER 2. Careful design and refinement yielded the INTERFACER 80, the most powerful real world interface on the market today. It has 8 inputs, each optically-isolated and 8 outputs, each with a relay contact. The INTERFACER 80 is fully compatible with our ANALOG 80, allowing these to be used together in order to create systems that control external devices based on "sensed" input under control of the TRS-80.

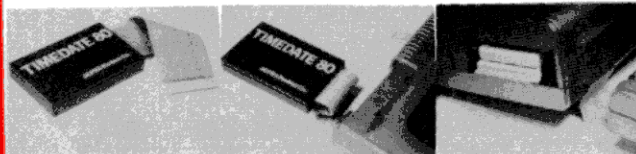
A FAILURE! In spite of our extensive advertising, very few are aware of the existence of the powerful ALPHA I/O SYSTEM.

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- The ALPHA SYSTEM/TRS-80 combination forms an incredibly versatile and powerful tool for acquisition/processing/control.
- In spite of its moderate cost, the system is sophisticated and reliable.
- The entire system can be easily programmed in BASIC using INP(X) and OUT X,Y commands.
- The modular approach and our EXPANDABUS allow for instant expansion as requirements demand.

The following pages contain more information about the devices mentioned here. We invite you to call or write to discuss your particular application.

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Expansion Interface

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- The instant power is applied to the TRS-80, TIMEDATE 80 provides MO/DATE/YR, DAY of WEEK, HR:MIN:SEC and AM/PM information with quartz accuracy.
- TIMEDATE 80 replaces the computer's internal clock. Extremely useful for automatic operation of remote systems with no operator in attendance. If the power fails and then is

WHY LOSE PRECIOUS TIME?

restored, only TIMEDATE 80 will update the system with current TIME and DATE information, an impossibility with the computer's internal clock.

- TIMEDATE 80 is quartz crystal based with INTELLIGENT CALENDAR, including provisions for leap year! TIME display may be by 12 hour AM/PM or by 24 hour military and European format.
- TIMEDATE 80 plugs directly into the rear of the TRS-80 keyboard and gives the "TIMES" function even without an Expansion Interface. For those with a disk system, it plugs into the left side panel of the Expansion Interface. An optional "Y" connector can provide for further expansion.
- TIMEDATE 80's small size keeps the computer table uncluttered. If you have an Expansion Interface, TIMEDATE 80 literally "DISAPPEARS" by slipping into the empty space in the bottom of the interface.
- Two sets of software, on cassette, come with TIMEDATE 80—"TIMESSET" and "TIMES". "TIMESSET" is a step by step set of simple instructions for setting TIMEDATE 80. "TIMES" is a set of poke routines which patch DOS and Level II TIMES to read TIMEDATE 80 and is easily incorporated into any user software. "TIMES" will always print the time and date when LISTING a program—great for keeping track of revisions!
- Other valuable uses for TIMEDATE 80 are: accurate date and time information for business reports like payroll records, financial reports, etc., or to various I/O devices requiring 24 hour clock input, such as laboratory instrumentation, and to communication systems needing "Log In/Log Out" data (bulletin boards).
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80 REVIEWS

Edited by Pamela Petrakos

*"The primary message is clear:
to avoid time-consuming costly pitfalls
when acquiring a first computer system."*

**So you are thinking about
a Small Business Computer**
Canning Publications
Vista, California
Softcover 100 pp.
\$12.50

by David W. Smith

Here is a manual designed to help the person who is unfamiliar with computers learn how to select a small computer system successfully. This is a highly organized book and the reader should have no difficulty following and comprehending the material.

The book is written for the small business owner who possesses a limited knowledge of computers, but who has at least one problem or task he/she believes a computer can solve or perform. This manual presents full coverage of the basic information you need for making an intelligent decision on system acquisition, without getting caught up in inappropriate technical detail.

The primary message is clear: to avoid time-consuming and costly pitfalls when acquiring a first computer system. This requires that the business person do his/her homework. Before seeing a single task performed by the newly installed computer, you will need to assimilate a fair amount of information on the subject. This manual contains most of the information you will need to know, and lists references for all the rest.

Dispelling Myths

In preparing you for the learning task ahead, the authors enumerate many of the benefits to be gained by computerization. This is no pie-in-the-sky outlook, but rather a highly realistic analysis. Warnings and cautions are given to help dispel common myths concerning computers. For example, the authors point out that anticipated savings in payroll frequently do not occur at first in the small business just because a computer has been put into service. Such a business usually has too few employees for the computer to replace any one of them entirely. The savings in payroll is likely to occur, however,

when business volume begins to grow, and the company finds it can do without proportional increases in staff. This is only one of the many illustrations given to help you develop a truer sense of the potential impact of the computer on your business.

The authors are thorough in their coverage of important basic information—how a computer works; what constitutes hardware and software; the differences among maxi, mini, and microcomputers and their manufacturers and sales procedures. A glossary of common computer terms is provided. There is also an excellent discussion on how to use a computer consultant effectively. The book includes many photographs of representative systems with captions describing the components, the capabilities and prices. An appendix lists leading suppliers of different sized computers.

All Facets of the Subject

All facets of the subject appear to have been examined. In laying out the procedure to help the business person assess his/her computer needs, the authors even

introduce and discuss the possibility of avoiding an in-house system by farming out the tasks to a computer service instead. Heavily emphasized, however, is the goals-oriented approach to choosing a system, starting first with the software. The authors repeatedly suggest searching out existing combinations of hardware and software which are already performing the desired job, and in the same line of business.

Finally, the text closes on the suggestion that, no matter what reason has prompted a business person to investigate computerization, chances are very high that a successful acquisition will open up more avenues of use for the system. The recommendation is that future expenses can be reduced or eliminated by purchasing or leasing a somewhat larger system than is required for the immediate job at hand.

For organization and thoroughness this text can not be surpassed. It will lead you to a clear understanding of the elements involved in the wise selection of a computer system without overwhelming you with technological jargon. ■

**Programming in BASIC
for Personal Computers**
David L. Heiserman
Prentice-Hall, Inc.
Englewood Cliffs, NJ
Softcover, 333 pp.
\$7.95

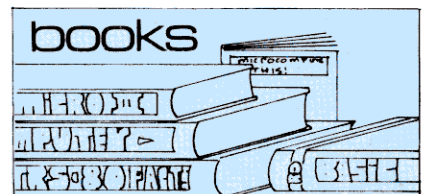
by Bryan Moran

If you just bought a microcomputer this book may be a worthwhile investment, but for anyone who has written a few BASIC programs it's not worth the price. There are no special techniques or innovative programming ideas introduced that are not covered in any elementary programming text.

Although the programs developed in this text are designed to run on any machine using Microsoft BASIC, the author had the TRS-80 user in mind.

Flogged Unmercifully

For the new TRS-80 owner, who has never programmed and needs to be led step by step through beginning BASIC statements, something is to be gained from studying this book. The reader is taken in a very deliberate fashion from powering up the computer through the common BASIC statements. Statements are illustrated by examples as they are introduced. Some, however, are flogged unmercifully. For example, in chapter four I counted nine illustrations of FOR...NEXT loops for timing delays, with little else of value in the examples. I considered



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Use existing software
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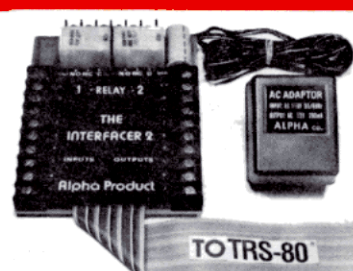
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—8 TTL/CMOS inputs. Input 0 and 1 are optically isolated
—Neat and compact design, very easy to use.
10 A = INP(0) "Reads the 8 inputs (if A=0: all inputs are low) 20 OUT 0.X "Controls the outputs and the relays
Assembled & tested, 90 day warranty. Price includes power supply, cable to KB or E/I, superb user's manual, free phone dialer program. \$95. Manual only: \$5.

GREEN SCREEN WARNING

IBM and all the "biggies" are using green screen monitors. Its advantages are now widely advertised. We feel that every TRS-80 user should enjoy the benefits it provides. But WARNING: all Green Screens are not created equal. Here is what we found:

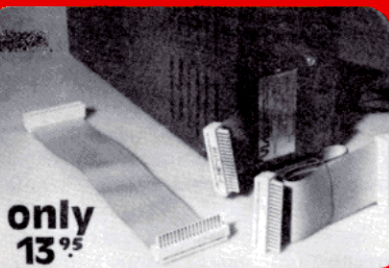
- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: "A pretend to 'reduce glare'". In fact, their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only CURVED screen MOLDED exactly to the picture tube curvature. It is Cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.

We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

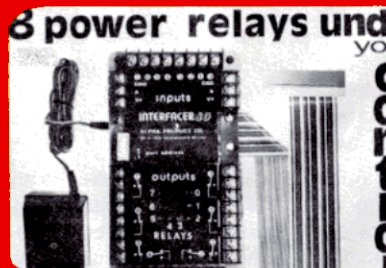
A last word: We think that companies, like ours, who are selling mainly by mail should wist their street address have a phone number (for questions and orders) accept CODs, not every one likes to send checks to a PO box offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it? Order your ALPHA GREEN SCREEN today \$12.50



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this an overkill.

I found it somewhat amusing that the author refused to refer to a BASIC interpreter. No reference was made to any program that allows the user's program to execute. Interpreters were referred to as "brands" of BASIC or even as (BASIC) "schemes."

Troubles

There are enough typographical errors scattered through the book to discourage the novice. However, most, if not all, should be picked up by the alert reader. On at least one flow chart arrows are mislabelled, but if the reader understands IF...THEN statements there should be no real problem.

More disturbing than typos is a sorting routine that works beautifully as long as at least one of the data is positive. The problem is in a segment where a search is made in an array for the largest element. Why the author chooses to set a temporary variable equal to zero instead of equal to the first entry of the array is beyond me.

An additional trouble spot is the

author's inconsistency when referring to rows and columns in two dimensional arrays. In one instance, the first subscript refers to a row while in the next it refers to a column.

Baited Breath

After learning how to use data statements we are told in chapter 12 that better ways to input data will be presented in chapters 13 through 15. With baited breath we wait. What? There is no chapter 15. What have we missed? This is in keeping with a reference in chapter five made to a nonexistent figure.

A habit a programmer should develop early on is to write good, accurate, and meaningful documentation. The author seems to think that simply keeping listings of a program, as it is developed, constitutes documentation. There is no real emphasis on variable listings, descriptions of what variables represent, how program segments or subroutines work, either in the form of REMarks or with accompanying written text.

A sore point with a lot of computerists is the use of multiple-statement lines. The

only advantage I see is memory conservation, which is rarely a problem for a beginning programmer. The author uses multiple-statement lines and encourages their use if the machine has a good editor. But he fails to point out difficulties with a line, such as:

```
120 IF A = 5 THEN 40: GOTO 10
```

which is taken from an example in the text. Under what condition is "GOTO 10" ever executed on the TRS-80? Never, but this fact is not pointed out.

In a text designed for a novice programmer it would seem that the concept of an algorithm should be introduced. The word is never used. This seems to be a disservice to the new programmer. What better time to introduce the idea?

In summary, I cannot recommend this book to anyone with even a moderate amount of programming experience. The book is inadequate in its coverage and suffers from poor editing. The novice could, however, learn enough from making corrections to programs to justify the expense. ■

TRS-80 Interfacing Book 2

Jonathan A. Titus,
Christopher A. Titus,
and David G. Larsen
Howard W. Sams
Indianapolis, IN
Softcover, 254 pp.
\$9.95

by George D. Dooley

This book, written by the Blacksburg Group, is the second volume of a series on interfacing the TRS-80. The first volume dealt with the signals available on the TRS-80 and software commands used to control I/O devices. It also dealt with the construction of simple I/O ports, address decoders and interfacing A/D and D/A converters. The second volume deals with more advanced and sophisticated interfacing techniques, such as data acquisition, signal processing, remote control, interrupts, and using D/A converters for graphics.

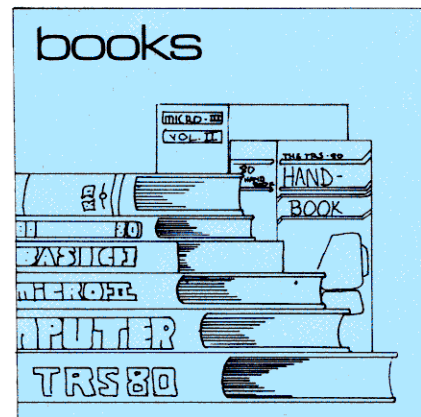
The first chapter is dedicated to the interface circuitry required to use the microcomputer to drive devices such as lamps and ac motors. This chapter includes a thorough discussion of open-collector type integrated circuits that can drive small loads. The rest of the chapter deals with controlling devices that are powered by the ac line. It covers the theory of the triac, the optical isolator (used to electric-

ally isolate the microcomputer from the ac line) and the solid state relay. All discussions are clearly illustrated by ample use of diagrams and by design examples using common integrated circuits.

Chapter 2 explains how to use the TRS-80 to generate and measure a signal that represents a physical measurement. To generate an external voltage a D/A converter is required. This chapter covers the construction and design considerations of interfaces using eight and ten-bit D/A converters. The discussion of D/A conversion continues, carrying into their application in computer graphics. The graphics are generated on an X-Y plotter, printing out data or forming patterns such as the sine wave.

An A/D converter is used to measure an analog voltage and use that value in a computer program. The interfacing requirements for an A/D converter are more complex than for a D/A converter and this section details the control circuitry well. Two data acquisition design projects are described. One measures the intensity of a light bulb as a function of its distance from a photocell, and the other measures ambient temperature from a solid state temperature sensing element.

These data acquisition projects lead into a discussion of the more practical aspects of the subject. Anyone who has ever operated a television near TRS-80 is aware of the noise it generates. The noise can be



superimposed on the signal we are trying to measure and induce serious errors. The effect of the imposed noise can be countered by techniques such as data averaging and digital filtering. Examples of both techniques are given.

Serial communication and remote control are the subject of chapter four. In some applications it's necessary to control events or to measure signals at a location removed from the computer. The problems that arise from using long lengths of expensive multiconductor cable to connect to the data acquisition unit, and the degradation of analog signals (resulting from the extended distance), can be solved by using a serial data link to a remote I/O device. This project, along with a detailed study of a serial data transmission, can be used as a basis for designing a home solar control system.

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Interrupts are the subject of the final chapter. Since the operation of interrupts can be confusing to a novice, visual aids illustrate the basic concepts of how a computer acts when it has been interrupted. Luckily, the text is full of useful diagrams. It's difficult to discuss interrupts while limiting the discussion to only Level II BASIC. The authors have developed BASIC language programs that POKE machine language commands into memory and then execute the program by calling it from the BASIC program, to illustrate certain principles of interrupt operation.

Clear and Unpretentious

Apart from the subject matter itself, what I enjoyed most about this book is its style. The writing style, like other books in the Blacksburg series, is clear and unpre-

tentious. Liberal use of diagrams, sample programs and tables make complicated concepts understandable. The authors describe useful interfacing projects that are general enough to be used for a wide variety of applications.

The only thing I didn't like about the book is the lack of documentation for some of the larger programs. Programs of only a few lines are not difficult to figure out, but a few well placed comments and a description of variables would sure help reader understanding of the larger programs.

Over all, my praises of this book far outnumber my criticisms. The authors have tackled a complex subject and have produced a book that is an excellent addition to the library of anyone who is interested in using the TRS-80 as a control system. ■

Pascal

David L. Heiserman
Tab Books, Inc.
Blue Ridge Summit, PA
Softcover, 350 pp.
\$9.95

by William L. Colsher

Pascal has recently become the number one buzz word among programmers just about everywhere. It is called the hottest thing since 16K RAM, and it's also said to be the language of the future.

Unfortunately, most of us haven't been able to determine whether any of the stories are true: the cost of admission has been far too high. First, there is the 48K two disk machine you need to run it, and then the \$150-plus price of a compiler. Pretty steep for an experiment!

Not long ago (1978) a couple of grad students at the University of Illinois developed a Pascal compiler called Tiny Pascal. Then in 1979, a company called Super-soft brought out a version of that compiler for the world's most popular micro—the TRS-80. Best of all, that compiler operates on a 16K tape-based system, the most popular TRS-80 configuration. Today that compiler is available from Radio Shack (and elsewhere) for only \$19.95!

Programmer's Guide

Heiserman has written the definitive programmer's and user's guide to Tiny Pascal. Three hundred and fifty pages of examples and exercises take you from loading the tape to writing sophisticated programs, in 16 easy chapters.

The first two chapters of *Pascal* are essential introductory material. How to load

the tape and use the various editing features are covered in enough detail to enable the first time user to sit down and get a program running within a few minutes. Saving a program on tape, compiling it (including the use of several compiler options and what to do about a number of errors) are all explained clearly and succinctly.

None of the pedantry that seems to infect many books on Pascal is apparent in this book. No "Integration by Simpson's Rule" here; just practical, hobbyist stuff like dice rolling and drawing pictures on the screen.

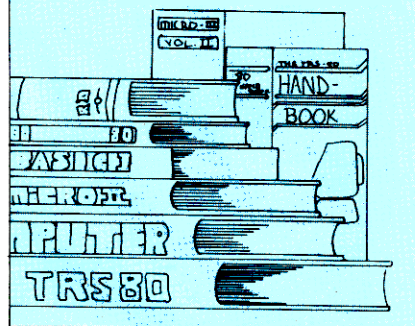
Chapter three introduces Pascal syntax diagrams. Learning to read these diagrams is critical to learning Pascal well. Once they are mastered you'll find it a simple matter to actually write programs in Pascal. After introducing the syntax diagrams, Heiserman dives into I/O with the Write statement. Chapter four goes into more detail on the many things that can be done using Write, including graphics and screen control. The idea of string and integer constants is also introduced through their use in the many examples of Write that are given.

Introducing Variables

The next two chapters, five and six, introduce variables and what to do with them. Special care is taken not to confuse BASIC programmers with the difference between an equal sign (=) and the Pascal assignment statement (: =).

IF...THEN...ELSE is covered in detail along with the Boolean operators AND, OR, and NOT. As is the case throughout this book, examples are clear and easy to understand; in virtually every

books



case there are complete programs you can enter and check out for yourself. Finally, syntax diagrams for all parts of Tiny Pascal are presented.

Chapters seven and eight present the looping features of Tiny Pascal: REPEAT-UNTIL, WHILE-DO, and FOR-DO. GOTO is not included in the list; the designers of Tiny Pascal refused to make any concession leading to unstructured programming and design. Once more, the when and why of using these statements are developed with clear examples that are meant to be typed in and run, not just read.

Chapter nine presents "A Miscellany of Pascal..."; a collection of most of the features you'll need when writing programs. The most important statement discussed here is the CASE-OF which is similar to BASIC's ON-GOTO. CASE-OF gives you the ability to do various things based on the value of some expression. PLOT and INKEY, for graphics and "on-the-fly" keyboard input, are also introduced.

Chapter 10 completes the introduction of Tiny Pascal features with procedures, functions and arrays. This chapter begins to use more sophisticated programs as examples. An animation of an inchworm is used as an example of the use of procedures with a parameter.

The next three chapters of *Pascal* consist of the practical uses of the language introduced in the first ten. Dice games, roulette, a slot machine, etc.

Chapter 14 is a good introduction to structured design and programming. Numerous examples show the development of several programs from idea to completion. A long program called Screwball Golf finishes off the chapter—15 pages of development and explanation!

Chapter 15 really puts it all together in a long game called Space Ranger. Detailed explanations are given of the techniques

used, including the reasons for structuring the program as it is. This makes the chapter a long one, but the 25 pages have a lot of detail to cover, not to mention explaining how to play the game.

Putting Ideas into Familiar Light

The final chapter of *Pascal* is one that I would have welcomed when learning the language: translating BASIC into Pascal. Each statement is covered in good detail, but because of the highly structured nature of Pascal and the unstructured nature of most BASIC programs, there is

really no easy way to make direct translations. Nevertheless, the chapter is useful because it helps the beginner put things into a more familiar light.

The appendix contains tables of cursor control codes, TRS-80 graphics characters, and the Pascal syntax diagrams. For some reason, a list of errors has been omitted, though one is mentioned early in the book, a minor problem considering the overall excellence of the book.

Pascal is, as I said, an excellent book, especially for the beginner. For less than

\$30 (the cost of this book plus Tiny Pascal) anyone with a TRS-80 can begin to learn the techniques of structured programming. However, I would like to voice one complaint. Many of the longer programs have evidently been typeset directly from computer printouts, although most of the examples are not. This can occasionally cause some ludicrous errors, such as spelling tomb "toubm".

If you are interested in Pascal programming get this book, the Radio Shack tape and get to work. It'll be the best 30 bucks you've spent on your computer. ■

Boss
Soft Sector Marketing Inc.
Garden City, MI
\$29.95

by Bruce Douglass

Boss, a utility program for the TRS-80, has several features useful in writing and debugging BASIC programs. They are: improved trace capability, single stepping through BASIC programs, reviewing variables, stacking programs, setting breakpoints and complete relocatability of the utility itself. Each of these capabilities will be dealt with separately.

The first thing you should know about Boss is that it comes on cassette along with a separate lowercase driver (if you have the modification) and manual. The program may be loaded into memory, relocated and saved on tape or disk. It runs in Level II BASIC or Disk BASIC.

Generally, when using Boss, you don't need to worry about it interfering with other machine language programs you may have in memory. When it loads, it will prompt you for the lowest address you wish to protect, and will relocate itself beneath that address. It also gives you the proper response to the memory size question.

I use Boss with a full-screen text editor for BASIC called XBE. In my 48K disk system, XBE loads in from 60416 and up. Boss loads in underneath and informs me to set memory size to 57571.

The nice thing is that I can keep both in memory, and both are operable. The programs will run well except when I use the command to review my variables; somehow that seems to eat the XBE program above Boss. The @ key becomes the control key for Boss (you must use <Shift> 0 for the normal @, but <Shift> @ remains the same). By pressing @ and a character you may access various Boss functions. The manual refers to @ as

<CON>, and I will use that notation here.

Trace Function

The first capability to be mentioned is the improved Trace function. By pressing <CON> and 1 at the same time, you turn the Trace off. <CON> 2 turns the Trace on and <CON> sends the Trace to a printer.

If you have ever tried to use the Level II Trace function, you noticed that it is hard to follow and destroys the display. The Boss Trace sets up the Trace so that it is only displayed in four rows in the right-hand corner. A right arrow moves to the row containing the executing line number. If the line is multi-statement, the line number is displayed only once during the execution of that line.

Sending Trace to the printer results in the line numbers being printed out along a horizontal line. The printer will continue to print the Trace until the program ends, the Trace is redirected, or turned off.

Boss is one of the most powerful tools I can use. It allows me to single step through the routines in the program and review just what the variables are doing.

To single step through BASIC, the following functions are available:

- <CON> 4 to turn single step off.
- <CON> 5 to single step to the end of line.
- <CON> 6 to single step each instruction.
- <CON> 7 to single step with a variable time delay.

All may be used in conjunction with Trace functions as well.

<CON> 5 single steps each line it executes. That is, when it begins to execute the next line, it will execute the entire line, and pause at the end of that line. Pressing <Space> will cause the next line to be executed.

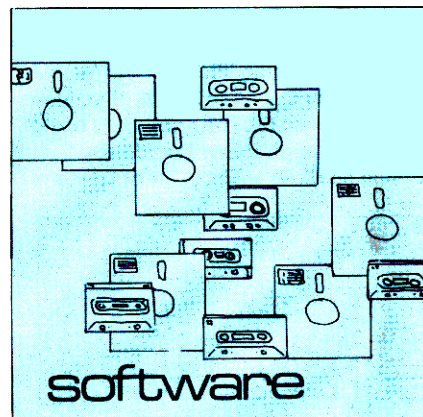
<CON> 6 will pause at each statement terminator ("."). Otherwise it is similar to <CON> 5.

<CON> 7 will cause a time delay before

executing the next line. The time delay default value is about one-fourth of a second. This single step mode may also be used in conjunction with single stepping by statement (rather than by line) and pressing "<CON>7 <CON>6." The time delay may be increased or decreased with <CON> <Up Arrow> or <CON> <Down Arrow>.

You may use as many breakpoints in the program as you like by inserting the line POKE 16667,5 wherever you need to break. You may include most of the Boss commands as POKE statements, so that your program will run normally until it reaches these commands, whereupon the Boss functions it calls for (for example, single stepping) will begin to execute. Thus you needn't worry about doing everything in Command mode.

The next useful capability is that of reviewing variables. <CON> N allows you to select the variables you wish to review, while <CON> 0 actually displays them. <CON> N may be invoked at any time. Upon the invocation of <CON> N, you will be asked for maximum variable length, followed by the variables to be reviewed. The number of variables you may review is inversely proportional to the maximum



variable name length. This is explained in the manual. <Break> terminates the function.

Any time during program execution, <CON> 0 may be invoked and the first variable will be displayed. From here, you may return to the program execution (where it left off) or select another variable to be displayed by pressing <BREAK> or C, respectively. Pressing any other key will cause the next variable (previously selected) to be displayed. As previously mentioned, use of this Boss function eats the program residing above it in high memory despite the claims by the manual that the other programs are protected. When I attempt to jump to the latter program with a SYSTEM ? and /60416, I get a reboot. I have taken to doing my text editing before using the <CON> N command.

In my opinion, the reviewing capability, together with Trace and Single Step make up the important functions of the program. You may stack BASIC programs up in memory and PUSH and POP them around as you like. You are, of course, limited by available RAM. In a disk system this is of little consequence. When you download a BASIC program from memory,

Command	Function
<CON> 1	Trace off
<CON> 2	Trace on (video)
<CON> 3	Trace on (printer)
<CON> 4	Single Step (SS) off
<CON> 5	SS to end of line
<CON> 6	SS instruction
<CON> 7	SS with time delay
<CON> up	slow execution (time delay)
<CON> down	speed execution (time delay)
<CON> N	select variables for review
<CON> 0	review variables
<CON> .	Save BASIC program in high memory (push)
<CON> :	Recall last saved BASIC program from high memory
<CON> 8	Append last saved program to current program
<CON> 0 (#)	Recall next-to-last saved program

Fig. 1.

it will destroy the current one in memory, so you also may switch the current one with the one in high memory. Memory size is adjusted automatically, so that the programs won't get eaten by BASIC variables and stack usage.

You do have the capability of appending programs, either the current program

with the last saved program or the current program with the next-to-last saved program. Line sequence must be correct for the appending to work properly. That is, the saved program line numbers should all be higher than the current program line numbers. Again, with a disk system and the ability to merge programs this is not particularly useful, but for Level II users it is a very handy ability to have. Thus their favorite routines (such as matrix inversion, or line printer routines) may be stored on tape with high line numbers and appended to the current program. If you append several routines, make sure you do them in the right line number sequence!

DOS users should be aware that reboots are an inconvenience here, as BASIC * will not recover the utility.

For the sake of completeness. See Fig. 1 for a list of the commands available in Boss.

In conclusion, this utility is a powerful debugging tool. Of importance to Level II users is the ability to append programs, even though a Merge would be more useful. This program is very useful for anyone who would like to spend some time away from program debugging. ■

Discat

Model I 32K/48K
Myatt & Smith
Tustin, CA
\$50

by Robert C. Daigh

When a little voice in your diskette storage box whispers "One of these days we've really got to get organized!", don't get upset—help is on the way.

If you are like most of us, you know you've saved a wonderful little program in there somewhere. And you need it right now... if only you could find it.

Bill Myatt of Myatt and Smith solved his frustrations, and ours too, with a machine language program named Discat. The Disk Catalog Index Program is for the TRS-80 Model I, with a Model III version soon to be released. The program is being marketed through Racet Computes.

Discat will load an index file of your pro-

grams in about twenty seconds, and then tell you where to find any one of some 17,000 different programs by displaying the disk number and indicating which side the program is on. (For a 32K system, reduce that number to around 7,200 programs.) The complete program listing for either side of any disk in your index can be displayed in answer to a Disk Number query.

The program automatically keeps track of the free space available and, on command, will display a listing of free space on each disk in the index. You no longer need to search for free space to dump a program in memory.

For those of us who really mean it when we say *organized*, Discat permits not one, but nine different index files, each of which can hold 800 program locations. Now you can have separate index files for business, games, utilities, data base, and so on.

The program requires an expansion interface, a minimum of 32K of memory and at least one disk drive. Up to four drives are supported. For best utilization of the program capabilities, a parallel printer should be part of the system.

Getting Started

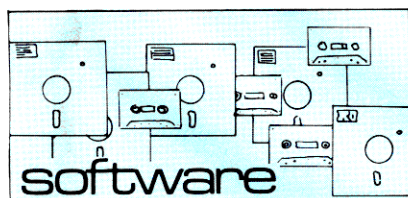
Detailed instructions describe each step involved in transferring Discat from

its distribution diskette to merge with your DOS system diskette under TRSDOS, NEWDOS+, NEWDOS80 or VTOS. The machine language program is called from DOS in the usual manner. During the short initialization period the program will search all active disk drives, loading the names of up to nine index files.

Each segment of the program is menu-driven. The main menu has the following options:

- Display catalog of indexes
- Program / disk search menu
- Display free disk space
- Create (or update) index
- Display the current index
- Print the current index
- Sort the current index
- Editing menu
- Special utilities
- Save the current index to disk

Setting up your own catalog of indexes is very simple; the program does all the tedious work for you. Two optional systems are discussed. If, for example, you choose to arrange all your utility programs onto one group of diskettes, the documentation suggests that you assign a diskette number in the 500-599 series for utility. Then you have only to insert each disk into the drive you have selected as



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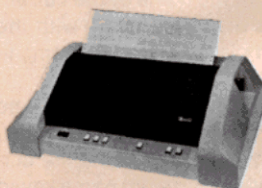


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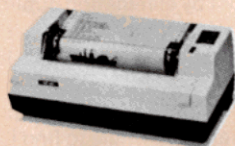


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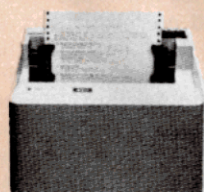


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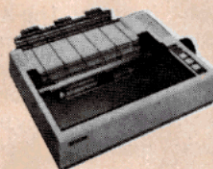
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update drive. Respond to the query with the diskette number and F (front) or B (back) side and the diskette data is read automatically. The screen now displays disk number, side, free grans, and the listing of each program with name, extensions and size in grans. At this point you may choose (Y/N) to add this entire diskette directory to the current index.

The authors have thoughtfully provided a much simpler system for you programmers who are a little lazy. You do not have to reorganize your entire disk inventory just to fit the program. (Who really has time to cull all his utility programs onto separate disks?) As each disk directory is read and displayed, you may selectively add to the current index any program on the display. You are asked:

—> ADD DIRCHECK/CMD TO CURRENT INDEX (Y/N) ?

Your response is displayed on the screen and the next program on that diskette scrolls by in sequence. Now you can select all your utility programs from wherever they may appear on your diskettes and organize them into a separate index.

Once the diskette identification is assigned, it is written to the diskette and need not be entered again. It can, however, be changed under the editing sub-menu. When you later prepare an index, let's say for games, you will have to insert each disk again and select all the game programs as they appear for inclusion into the games index.

The user is warned that non-standard DOS diskettes such as Pascal, Forth, and CP/M must not be inserted into the update drive. The writing of diskette identification might cause irreparable damage to non-standard systems. Fear not that these disks must lie unwanted and unclassified in your collection. Discat allows manual entry of the diskette number and all its programs into whichever index you may choose.

This is all easier to do than it is to explain. On my first trial run I assembled a composite index of 529 programs from both sides of 32 diskettes. The time went by quickly and I enjoyed seeing all those program names I had forgotten I owned.

Using the Indexes

Nine separate indexes can be assembled and saved by the program. Now let's find out how to use an index.

From the main menu, one calls the sort sub-menu, then chooses to sort the current index either by program name or by disk number.

A short buzz sound from the expansion interface notified me that my 529 pro-

grams were now sorted; it took less than 14 seconds, after which I was returned to the main menu. Display of the current index can be either in streak or page mode. Streak provides a scrolling display that can be stopped and restarted by touching any key. The X key aborts the scroll and returns to the main menu. One may select to display only those programs with like extensions, for example /PCL or /CMD.

A hardcopy printout of the current file in memory can be set for either single column or double column format. The user is asked to set the number of lines per page; each page is numbered and identified by index name. The listing includes program name and number, diskette number and side, and the size of the program in grans. Each page lists 110 programs under the double column format.

Probably the most useful routine in Discat is the search program. The sub-menu lists:

- 1—Display Disk Directory
- 2—Program Search
- Choice ?

If <1> is selected, the user is asked for diskette number and side, whereupon the chosen directory is displayed. Upon keying the <2> selection from menu, you are asked to enter program name and extension. Searching by program name does not require that the entire name be entered. Suppose you wanted to locate the program named Termites/BAS. You could shorten the program name to Termites without the extension and the screen would respond with:

Termites/BAS

Termites/CIM
Termites/CMD

provided, of course, that your index contained all three items.

The search could be broadened by asking for Term, in which case the screen will respond with all programs beginning with the key letters TERM----. The search key could be just T, which would display every program beginning with the letter T and your Termites/BAS would be there in proper alphabetical order.

A full editing menu allows deletion of a specific program or an entire diskfull of program names.

All sub-menus return the user to the main menu where the name of the current index is always displayed along with the total number of disks and of programs in that index.

The current index in memory may be saved to disk at any time. The program allows the index to be saved under the current name or under a different name keyed in by the user.

The program satisfies just about every need I could envision for a disk file organizer. It is easy to use, fast, adequately documented and capable of handling far more information than most TRS-80 users will probably need.

When I discovered how many diskettes I could recover just by eliminating duplication and recapturing unused space, the savings in diskettes nearly equalled the price of the program.

Best of all, though, I know what program material I have and where to find it in a hurry.

At last, I'm organized. ■

Silver-It
Fuller Software
Grand Prairie, TX
\$5

by Paul R. Prescott

As with most TRS-80 users I was slowly being driven crazy by the unreliable contacts between the keyboard and the expansion interface. Although the well-known trick of cleaning the circuit board connections with an eraser worked, my '80 had reached the point where this was necessary before each session! Then a small Fuller Software ad caught my eye. They promised that a \$5 investment in Silver-It would put an end to spontaneous reboots. Their response was quick, and the kit was received within one week.

Not For the Beginner

Imagine my surprise when I opened the package and found no instructions for use. A disclaimer was enclosed that warned the purchaser that silver soldering is not for the beginner and that computer circuits are delicate. To their credit, Fuller offers a full refund to anyone who does not feel up to the challenge, but I feel this warning should be included in the advertisement.

The kit consists of a small piece of solder wick and several inches of silver solder. Being the brave sort, with a lot of soldering experience, I pressed on. For those of you who might wish to give it a try, here's my approach.

First, you need a 25-watt soldering iron, absolute alcohol, and liquid rosin flux. Absolute alcohol is available at liquor stores under the name "Everclear," and is used

to clean the contacts. Don't try to substitute with rubbing alcohol. The rosin flux is needed as the solder rod is flux free. Be certain not to use the acid flux that is generally used for soldering.

Place the keyboard face down on a clean cloth to avoid marring the keys. Remove the six screws from the bottom, keeping track of which screws belong in which holes, and place the base off to the side. Very gently lift the main circuit board; you will see spacers separating it from the keyboard circuit. Remove the spacers without flexing the cable connecting the two boards, then lift both boards out as a unit. Use the alcohol to clean both sides of the circuit board contacts and allow them to dry.

Radio Shack saved a few pennies by coating the contacts with regular solder instead of silver or gold; this solder must be removed. Heat each contact with the soldering iron while using the solder wick to remove the old solder. Be careful not to cause a solder bridge between contacts.

Next, clean the contacts again and immediately coat the surface with the rosin flux.

Applying the silver solder is relatively simple. Start at the outer edge and heat the contacts with the iron. Touch the silver solder to the edge, at the same time start to move the iron and the solder towards the center of the board. Keep the solder just behind the iron in continuous contact with the board. When the inner edge is reached lift both off together. You should achieve an even, shiny coating without much trouble. After all the contacts on both sides have been soldered use the alcohol to remove any residual flux.

After checking your work for solder bridges or large lumps in the solder track, gently place the circuit boards back in the keyboard top. Very carefully reinstall the plastic separators on the posts and reassemble the base.

The interface procedure is exactly the

same. I silver soldered all the edge connectors on the interface board in hopes of avoiding any future problems. The entire procedure took about two hours.

Practice First

Since reconnecting the computer six months ago, I have found no immediate problems. Everything still functions perfectly, no spontaneous reboots and no more eraser cleaning sessions!

This method, however, is not a cure to be applied by anyone not familiar with good soldering techniques or aware of the delicacy of computer circuits. With the keyboard wide open a stray static discharge could easily zap a chip. If you have soldered before but not along edge connectors, I suggest that you pick up a blank board with connectors at Radio Shack and practice first. There is more than enough silver solder to do this provided you don't go overboard. If you have the experience, join the fun! My TRS-80 now works as reliably as a new unit! ■

Speak-2-Me-2
Percom Data Co., Inc.
Garland, Texas
\$69.95

by Edward Louis

This is a review of the Percom Speak-2-Me-2 interface hardware, and the accompanying manual and software, used in conjunction with a modified Texas Instrument Speak&Spell and a TRS-80 Model I computer. Although I used a disk system with TRSDOS 2.3., the Radio Shack Expansion Interface unit and a General Electric Terminus 300 printer, these additional peripherals are not necessary to make good use of the hardware.

A few years ago I was associated with a Navy project that made use of a Votrax speech synthesizer. Every time I walked into the lab and heard the droning voice giving voltage and power readings in what seemed to be a slightly Swedish accent, I had to pause for a moment to realize that this was a computer "talking" and not some poor lab assistant chained to a set of meters. Needless to say, I was intrigued by the prospect of having this kind of electronic wizardry to experiment with.

Then an advertisement for a Percom interface device to work with the TI Speak&Spell caught my eye. It was called Speak-2-Me-2 and it sounded like the answer.

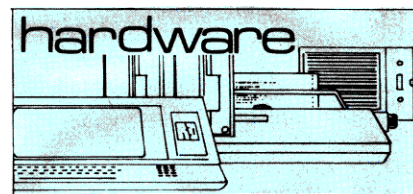
I took the plunge and bought the Speak&Spell and ordered the Speak-2-Me-2 unit from Percom.

The Percom advertisement said that the device, when used in conjunction with a modified Speak&Spell, could be the voice of a computer through the use of a few BASIC program lines. It stated that some modification of the Speak&Spell was necessary and that an external power source was needed. It also mentioned that either an expansion interface or printer cable adaptor were required, and that an advanced speech driver and games disk was available.

When my package came, I examined the contents and found a small printed circuit board and a twenty-two page manual.

Glancing through the material I noticed a standard warranty, a release form if I were to choose to send the interface and the Speak&Spell back to Percom for modification (along with \$25), and a number of warnings. There was also a separate envelope containing a ribbon cable with connectors at both ends.

As well as this overall package was presented, there were two items that confused me from the start: First, I could not tell from the advertisement, the documentation or any marking on the hardware which cable assembly I had. In any case, it eventually worked with my expansion interface. Second, one of the separate sheets of warnings and cautions stated that under no circumstances would Percom undertake installation of the Speak-2-Me-2 interface in a previously tampered-with Speak&Spell. Within the manual, however, I found a statement that suggested that after one had tried everything



and been unable to get the combination of devices to work, they could be sent back to Percom with an initial repair fee of \$15 and Percom would attempt to correct the difficulty. In fact, the statement went on to say that they had never found a unit that couldn't be repaired satisfactorily.

Initially I was disappointed because there seemed to be a very small amount of hardware for \$69. I eventually realized that more than half of what I paid for was the knowledge and facility to get to the heart of the Speak&Spell and make it work with my system.

The manual stated that if the modification was beyond the buyer's capability or if the hardware in the Speak&Spell was in any way different than that depicted in the manual, the whole package, including the Speak&Spell, could be returned to Percom along with \$25 for them to do the modification. The other alternative was to send Percom's package back and get a full refund.

Documentation

In the main body of the manual, several detailed diagrams were found which showed a number of different views of the circuit board inside the Speak&Spell. The warning was repeated in the text stating that unless the circuit board of the

Speak&Spell being modified looked exactly like the diagrams, the modification should not be made.

An additional page in the manual described a new keying technique for the two connectors which connect the Speak-2-Me-2 interface to the Speak&Spell and to the computer. My unit did not employ the missing pin keying as described, but used red paint on the connector and on the board to indicate connector polarity. This worked well, along with the explicit diagrams showing proper ribbon cable dress.

I have to conclude that the manual is quite thorough. The mechanical and electrical detail was precise and understandable, there are some BASIC programs to run on the new system, and an additional section contains not only a machine language program and a verbal flow diagram, but also some explanation of how this device could be interfaced with other computers, (although none were specifically identified).

The software in the manual was limited to a driver program in the form of a BASIC data POKE, a short program producing a single sentence (rather humorous but I'll let Percom surprise you) and a simple game program with part of the interaction coming through the Speak&Spell.

These programs were easy to type in and use, as soon as I realized I was under TRSDOS BASIC and had to use DEFUSR instead of POKEing the starting address of the machine language portion into the locations. The only other problem I had with Percom's software was the format used. For some reason, the programmer decided to use multiple statement lines and to place the : separating them at the beginning of each new line. For example:

```
10 X = 1 TO 100
: A = PEEK(X)
: PRINT A,X
20 NEXT X
```

In my opinion, this is a difficult form to edit and doesn't add to clarity.

Modifying Speak & Spell

First, there was the mechanical problem of opening up the Speak&Spell box and getting access to the circuit board on both sides.

Next, the trick was to locate a pattern on the printed circuit board identical with that in the diagram. I found this more difficult, but I finally thought I had come close enough to do the deed. The modification required either cutting or unsoldering the integrated circuit leads or cutting the runs from those leads to the rest of the board.

The manual suggested that cutting the runs would result in less risk to the chip in question. Fortunately, I followed their suggestion, as it turned out I made the wrong cuts on this first try.

After making these changes, it was a simple matter to solder the two jumper wires and the six ribbon cable connections as specified. Somehow, when I finished things didn't look exactly right, but I proceeded to insert the Speak-2-Me-2 in the battery compartment and connect the external power supply. Before connecting the finished product to the computer, I turned on the power and found that most of the Speak&Spell still worked normally, although a few of the letters would not respond audibly when pressed.

I proceeded to tie in the computer and then typed in the various programs described above and ended up spending an entire evening debugging programs and trying to figure out why there was no computer control.

The next evening, after having thought a bit about the problem, I decided I had been and should take the unit apart again to see if I could figure out where I went wrong.

Somewhere during this activity, I happened to turn to the end of the manual and found an addendum with a circuit diagram which exactly matched my unit.

I had to restore the original condition of the circuit board and start over. The difference was essentially a 180 degree reversal

of the chip on the board. Within a few minutes I was ready to try the unit again.

I turned the power on before tying into the computer. This time nothing at all happened. This could be disaster... or maybe the computer had to be in the circuit to turn the unit on.

After connecting to the parallel printer connection on the expansion interface unit and going over all of my programs, I still could get nothing from the unit.

At this point, I decided to break down and haul my old Tektronix 514 oscilloscope up from the depths of the cellar and see where things were going awry. I did this, but in the process I had removed and replaced the connector to the expansion interface unit and—you guessed it—the Speak&Spell started to talk although it was mostly R2D2 type noise with only a couple recognizable words.

I had been using a home-brew 10-volt supply to run the unit after finding that a standard nine-volt battery did not have sufficient current capacity. The manual suggested using the Radio Shack PN 274-251 power adapter. I purchased one and found it to work very well, with more than enough current capacity.

At this point I had added a useful new peripheral to my system and I was ready to experiment. Percom offers a separate software package to give an expanded vocabulary of partial words, etc. For myself, I much prefer the challenge of experimenting on my own. ■

The MicroConnection
The MicroPeripheral Corporation
Redmond, WA
\$249

by Eric Keener

Dial-up systems for the computer hobbyist are relatively new. Such a system used to require an expansion interface, the optional RS-232 board, and then, an expensive acoustically coupled modem. This adds up to at least \$650 just to get on-line.

The MicroPeripheral Corporation (formerly the Peripheral People) now has the MicroConnection. As a matter of fact, they have a whole line of MicroConnections, but, I will only deal with the version for the Model I TRS-80. This modem is FCC accepted, directly connects to the phone line, and does not require an expansion interface or any sort of RS-232 interface. For that matter, it has its own RS-232 port for driving a serial printer. Also, its RS-232 port provides it with the ability to

operate as a stand-alone modem. That is, you can disconnect the MicroConnection from your TRS-80 and connect a standard RS-232 compatible serial terminal (set for 300 baud) to the serial port on the modem. This allows you to connect your terminal to the phone lines without your TRS-80.

The MicroConnection operates at 300 baud, but can be converted to run at 110 baud through a simple hardware modification that is described in the operator's manual. The word protocol is under software control, thus, you set the MicroConnection to operate with even, odd, or no parity, a 5, 6, 7, or 8-bit word, and 1, 1.5, or 2-stop bits. The magic behind this control is an 8251 USART that is used in the MicroConnection. The MicroConnection also provides an input and output to be used with your amateur radio equipment for ASCII Bell 103 standard teletype. So far, though, I have not tried this feature as I haven't been able to find any activity using the Bell 103 standard (200 cps shift).

The MicroConnection comes with a dumb terminal program, on cassette,

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80 MICROCOMPUTING ANNOUNCES...



...and saves you hours of typing and aggravation.

LOAD-80 is a monthly dump of the major program listings in *80 Microcomputing* on cassette. Publisher Wayne Green tells you more...

"Frankly, after hundreds of hours of frustration, I seldom even try to keyboard a published program. Even if the magazine manages to get the program typeset correctly (which seems rare), I inevitably screw it up when I keyboard it. Who needs the aggravation?"

"This is why I've started a new series of cassettes called **Load 80**. Each cassette will have program dumps of the listings in an issue of *80 Microcomputing*. These listings are direct from the authors and tested by the *80* staff. All but the very short program listings will be on these **Load 80** cassettes. Thus you will be able to save hours of inputting programs and even more of debugging your keyboarding errors.

"Though the authors of these programs will share the royalties from the sale of the cassettes, this will not preclude the better programs from being issued separately by Instant Software (with royalties) with full documentation and associated hoopla. The documentation for the **Load 80** programs will be entirely in *80 Microcomputing*.

"I originally was holding out for "Trash Dump" as a name for the cassettes, but cooler heads prevailed. If there turns out to be enough interest in **Load 80**, we'll set up a monthly subscription arrangement."

Wayne Green, Publisher

The Load-80 cassette is simply the program listings that appear in the articles in *80 Microcomputing*. It was created to save you the time involved in typing in the listings yourself. Successful loading of the programs depends on reading the documentation in the articles. If you have your current magazine at hand when you load the cassette, you should have no difficulty. If you still have problems, please return the tape for a replacement.

Send in the attached card and you will receive the cassette for the major programs in this issue. If the card is gone, photocopy the coupon.

Please note there is no warranty expressed or implied that this program is going to do anything other than save you typing.

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Please allow 4-6 weeks for delivery
80 Microcomputing Pine Street Peterborough NH 03458
Attn: Debra L. Boudrieau

8007

called S80. This program provides redefined keys to transmit the following symbols:

Up-arrow 1-Escape
Up-arrow 2-Left brace
Up-arrow 3-Right brace
Up-arrow 4-Vertical broken
Up-arrow 5-Wave
Up-arrow 6-Back slash
Up-arrow 7-Back apostrophe
Up-arrow 8-Left bracket
Up-arrow 9-Right bracket
Up-arrow 0-Null

By the way, the up-arrow is your control key so you can transmit any other control code. The manual provides the addresses to change, if you wish, to redefine the above special characters. Due to the uniqueness of the TRS-80 character generator, characters six, eight and nine will

show up on your screen as different symbols. If you have the new character generator IC in your keyboard, characters five through nine will show up different on the screen.

S80 also provides for printing the screen on a parallel printer. The command mode is accessed using a shift up-arrow. Shift up-arrow P turns on the printer and shift up-arrow S turns it off. Also, shift up-arrow E returns you to Memory Size? and shift up-arrow I returns you to the initialization routine for setting half or full duplex.

I did have one problem which I attribute to my ignorance of word protocol. Regarding the changing of parity and word length, I tried changing the MicroConnection to transmit with even parity. Also, I attempted to transmit an eight-bit word. To those of

you who don't know, the total of the parity bit plus the word bits can only equal eight. I tried transmitting nine. Needless to say, it didn't work. Once I discovered my error, changing the protocol was easy. POKEing a 122 into 17229 produces even parity seven word bits, and one stop bit. A 90 produces odd parity, seven word bits, and one stop bit. So far, though, I have not found a need for odd parity.

The MicroConnection provides an easy and efficient method of checking into the various bulletin boards (Forum-80, ABBS, etc.) as well as CompuServe and The Source. Also, the MicroPeripheral Corporation has a whole line of smart terminal programs as well as the other MicroConnections. It is well worth the investment to get into this exciting and interesting facet of the computer hobby. ■

MM + (Memory Expansion)

Exatron
Sunnyvale, CA
\$399

by Harley Dyk

Owners of the 16K Level II TRS-80 Model 1 generally feel that they own a cost-effective computer. If you do a lot of programming you rapidly learn what the OM error means (programs always seem to grow and fill or exceed available memory). Most of you are not content with a cassette-based system and often turn to disks: Stringy Floppy, Beta-80, TC-8, etc. In either case, more memory and/or a floppy controller is often needed.

The MM + (memory + interface) recently released by Exatron is a quality alternative to the Radio Shack expansion box and could cost you less depending on your situation.

Standard Features

The unit is designed to fit under the TRS-80 monitor and comes fully assembled. Standard features are: 32K of memory, built-in power supply, serial printer port (RS232-C), real time clock, light pen port, parallel printer port (Radio Shack/Centronics compatible), and a general parallel port (IBM Model 50 compatible). A floppy interface was not included as a standard feature since the unit was designed for TRS-80 owners who need more memory but do not own a floppy disk.

A floppy controller and an additional 32K will be the first options available on a second circuit board (which will fit in the

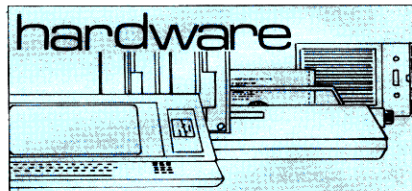
present chassis). The present power supply runs at or under 50 percent capacity and will handle the additional load.

Stringy Floppy owners are being polled by Exatron as to their preference regarding options for the second board. Exatron hopes to offer the options in the order of preference indicated by the needs of its customers.

Options Under Consideration

Some of the options under consideration are: RS232-C serial I/O, hard disk controller, color graphics, communications

Size	17" x 7" x 3"
State	Assembled only
Memory	32 K only
Floppy interface	No (but an option soon)
Real Time Clock	Yes (can use with Level III Basic)
Serial I/O	Printer output only (300 & 600 baud)
Parallel Printer Port	Yes
Light Pen Port	Yes
Bus Extender	Yes
On-board power supply	Yes
Warranty	1 year/30 day money back
Dealers	None, mail-order or order through program chairman (selected Stringy Floppy owners)
Toll free number	Yes—800-538-8559
Contact	Exatron 181 Commercial St. Sunnyvale, CA 94086
Misc.	Guaranteed to run at 3.55 MHz, has memory bank select circuit so can add another 32 K, has on board memory-mapped address decoding



modem, IBM Model 50 bidirectional interface (use typewriter keyboard), port FF audio output circuit (for sound effects), IEEE-488 bus interface, A/D and D/A interface, multi-port parallel I/O, and a TRIAC/SSR/OPTO-isolator control interface.

Unique Features

The light pen port is a unique feature of the MM +. Most light pens can be used with a cassette recorder serving as an amplifier, however the port on the MM + is more convenient and leaves the recorder free. The port was designed for the Photopoint light pen by MicroMatrix but should work with any light pen that is designed to connect to a cassette recorder.

Exatron offers a speed-up kit for the TRS-80 that allows you to run the computer with a 50 percent or 100 percent increase in speed. The MM + is guaranteed to handle the 100 percent increase if your CPU board and memory will run at the 3.55 MHz frequency.

If you have no immediate need for a floppy interface and need more memory, this unit deserves your consideration. I have used my unit for several months with no problem, and have subjected it to overnight memory tests to confirm its quality. It works well with disk alternatives such as the Beta-80 and the Stringy Floppy. It should satisfy your memory requirements for the time and give you many additional, useful features. ■

Fig. 1. Major Features of the MM +

From p. 8

tween TRSDOS and 3741 single-density IBM-format diskettes. Conversion between EBCDIC and ASCII character sets is also done. So now, for \$249, the Model II can become conversant with IBM at the diskette level. Catalog number is 26-4714.

Around August 1, we should also be shipping two new BiSync Communications packages for the Model II. One is a 3270 package, which allows communica-

tion with IBM Systems 360/370 and 30-Series CPU's, or any non-IBM devices equipped with BSC 3270. Catalog number is 26-4715, and the price is \$995. The other BiSync package (3780) allows the Model II to function as a remote job entry terminal. You can select the use of IBM 2770/2780/3780/3741 protocols and communicate with IBM System 360/370, 30-Series, IBM 2780/3780 terminals, DEC PDP-11, VAX-11 or other devices equipped with binary synchronous communications capabilities.

(Cat. no. 26-4716, also priced at \$995.) For all three of these new packages, synchronous communications are through the A serial port on the Model II, and may operate at up to 19,200 baud, depending on length and type of communication connection used. Only half-duplex communications facilities are required. Installation is also required.

I have some plans for something very interesting next month... if I can do it. See you then. ■

80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

The annual New York State Society of CPAs accounting show and conference was recently held in New York City. This show included a series of informative seminars and an exhibition of accounting-related equipment and supplies provided by local and national vendors.

Our firm provided a speaker for one of the scheduled seminars. The seminar, "Word Processing for the First-Time User", was completely filled. Obviously we had picked a topic of great interest.

This impression was amply confirmed as I toured the exhibition hall. It seemed that every other exhibit dealt with a computer related product or computer system. Apparently, the skepticism of the past is quickly yielding to enthusiasm as practitioners rush to embrace automated systems.

As I wandered through the exhibits, I found the large number of competing systems bewildering. Every vendor seemed to have the same software packages on display—word processors and general accounting systems. With each vendor touting the technical superiority of his or her system, I could see how a novice could become quite confused.

Whatever the apparent benefits of any software/hardware configuration, the novice should ask "How many are installed," "Where are they installed," and, "What users can be contacted". A vague or evasive answer to any of these questions should trigger an abrupt retreat.

A new computer user should always pick hardware and software which have the widest distribution. If help is needed, other users can be contacted to provide advice. There is nothing more comforting than an

informative talk with someone who has been there.

Business Systems Users Group

Although '80 owners have a lot of company, there is need for an '80 business systems users group. The new COBOL business systems differ significantly from the BASIC systems initially offered for the Model II. These systems have different file handling procedures and require the development of custom interfaces to expedite data entry and processing.

Many users of the new COBOL systems

commercial use for over 20 years. But until very recently, COBOL systems were only available on large computers. The COBOL system available on the Model II is quite new.

Tandy's decision to implement new Model II business software in COBOL was a reasonable one. There is probably no other language in which more business programming talent is available. Also with COBOL, business system designs can be protected since the source code need not be distributed with an executable system.

ISAM

The COBOL system implemented on the Model II gets much of its speed and flexibility through the use of ISAM (Indexed Sequential Access Method) file structures. This type of file organization stores key words used to control access to random data files in special sequential files called index files. When you want a record, locate the key word in the index file and obtain a pointer to the random file.

Although this method of file access is available to the BASIC programmer, use of the method requires coding. With the COBOL system, the COBOL compiler generates ISAM coding. The use of ISAM file structures is, therefore, transparent to the programmer and easily implemented.

Since the ISAM index must be updated after a random file is altered, the disk must remain in the computer until a job is completely terminated. Obviously, removing a disk in a COBOL system could be dangerous. With this in mind it is a bit difficult to understand why Radio Shack is releasing a three-disk system which requires disk swapping.

"The skepticism of the past is quickly yielding to enthusiasm."

have file problems caused by improper handling of system diskettes. If a job is not terminated by returning to the main menu and exiting to the operating system, an application file in use could be destroyed. The scary thing about this situation is that the bad file can then be backed up without any indication of error. The unfortunate system user finds out about the problem the next time the file is required.

This situation and others occur because the COBOL business system users are, in a very real way, pioneers. In last month's column, I indicated that COBOL is a business system language that has been in wide

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More than 100 Interludes are included in the program. Most are described in detail in the accompanying manual, but several surprise Interludes are buried in the program awaiting that very special time when your interview says you're ready. (When you learn secret Interlude #99, your love life may never again be the same!) Interlude can give you experiences you'll never forget. Are you ready for it?

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Examination of the directories of the first three-disk COBOL system, Accounts Receivable, provides the answer. The package is supplied with six diskettes: Three systems diskettes containing programs and three data diskettes. The first systems disk contains 38 programs and six data files, the second disk 14 programs, and the third 27 programs.

Obviously this system is too big to fit on a single diskette. Why three data diskettes? This system is only one element of an order/invoicing system. The other elements—Order Entry, Sales Analysis, and General Ledger use some of the same files. The Accounts Receivable system maintains permanent data files and generates data which the other systems use for user reports.

Advantages of the Receivable System

I am tempted to compare the receivable system to the single-disk receivable system examined last month. If this is done carelessly the new system hardly seems worthwhile. The single-disk system, if expanded to its maximum capacity of three drives, can handle up to 1800 accounts with 4100 open transactions. The latest system can only handle 800 accounts and 2500 open items.

The difference between the two systems lies in the analytical data which the new system can accommodate. The new system increases the number of general ledger account distributions from 26 to 100. With this quantity of general ledger accounts available a more detailed sales analysis is feasible. This should give a system user a better handle on sources of gross profit contribution by product line.

The system also accommodates the accumulation of standard cost data. With this statistic it is possible to develop a customer

"Obviously, removing a disk in a Cobol system could be dangerous. . . ."

profitability profile, and there is evidence that such reports will be developed by the sales analysis module.

The new system accommodates up to 100 salespeople. A report is available that can be used for the preparation of sales personnel commission reports. To provide the detail required for this report, a special file is set up which accommodates up to 6000 lines of data.

In short, Tandy has developed a big business receivable system for the small firm. Unfortunately the relatively small number of accounts that the system can handle will limit its application. However, when and if the long rumored hard disk subsystem is released, the software will be ready.

However, if the system fits your needs you get quite a bang for a buck. The system has a tab indexed oversized binder. The indexing divides the documentation into separate sections for each processing operation. Each section preserves detailed instructions, and devotes particular care to specifying the range of acceptable entries required for each item on the CRT screen.

Each section provides sample data to aid the novice in learning systems procedures. The user is urged to enter this data and compare the resulting reports with the sample printouts provided. This method is quite effective in shortening the learning curve.

This method also provides an insight into the enormous amount of company data which must be entered into the system before processing can commence. The problem becomes obvious on the first data screen. In addition to the company name and address the user must decide whether or not to use profit center accounting. A no answer will affect the output from the system and the resulting financial reports generated by the general ledger system.

In the second screen, the user must decide on the format of the aging report, finance charges, and whether or not to use preprinted statements, account distributions, and sales personnel commissions. The answers to some of these questions should not be developed while entering data on the CRT.

Before you install a system with this potential, carefully review company records and the current management information system. Questions concerning profitability improvement and sales management should be considered. If possible, new directions should be defined and the order/invoice system used as the means of implementation.

In operation, the screens are clear and uncluttered. As options are selected, future data entry screens are affected. For example, if profit center accounting is not selected on the first screen, only a four-digit account number would be allowed on the second screen. Consider the interaction of the screens carefully when answering each question.

As data files are built, the files are used to check subsequent entries for validity. When entering a customer's data, the salesman number, ship via code, terms code and tax code are validity tested. All of the above as well as customer sales, cost of sales,

commission paid and account balance are part of the customer master file.

The system then allows an open file to be created. At this point the documentation becomes somewhat confusing. The screen refers to two amounts which must be entered for each document. For unexplained reasons, the system requires freight charges to be separately identified on invoices. Discounts and allowances must also be segregated on payments. A note of explanation from the system designers would be helpful at this point. Segregating these balances during conversion will be quite a job and the option of avoiding this messy operation should be available.

This system, like all Radio Shack receivable systems, allows both balance forward and open item accounts. In addition, it can use miscellaneous account numbers. You can use these numbers for one-time or occasional customers. This avoids the trouble of setting up a master file for every new customer and should permit installation of

"Tandy has developed a big business receivable system for the small firm."

the system in many firms which ordinarily would have too high an account volume to be considered candidates.

Once the files have been created, the system user will have a good familiarity with operation of the system and the screen design. Unfortunately the screens are not as informative and easy to use as previous Tandy accounting systems.

Some Differences

Unlike the General Ledger, the system doesn't make full use of cursor control for editing. If an error is made and not recognized until after Enter is pressed, backspacing the cursor to the previous line is not possible. The screen must be completed and the offending line number referenced for correction.

In addition, the Tab stop terminates processing and escapes the screen. This differs from procedures in other accounting packages and Scripsit where F1 and F2 are used. This system uses the special function keys during data entry and there may be some confusion for users of other 'Shack products. Regardless, the most regrettable

flaw is that these key functions appear only in the documentation and are not displayed on the screen during processing.

Post Invoicing Sales Entry

Although this receivable system is just one module in an order-invoice system, it does contain a post invoicing sales entry routine. If implemented as a stand-alone system, it is the normal method for entering sales invoices. With this routine, entering an invoice is a two-screen operation. First, details of the overall invoice are entered. This consists of the customer number and 11 other pieces of information required by the system.

If the company requires a departmental sales analysis, the routine presents a second screen which allows distribution of the items sold to accounts affected. The user must enter a valid account number and amount. During the data entry procedure, the system displays the total amount and the amount distributed. Exit from the screen is not possible unless the amount distributed equals the amount invoiced.

Clearly this information is best developed during the preparation of an invoice. If invoice volume is substantial and the integrated order entry system is not going to be purchased, a custom invoicing program should be considered. This will require purchase of the COBOL development system and the accounts receivable source code. A COBOL programmer will have to be retained to do the programming.

Printing Capabilities

Much thought has gone into the develop-

ment of the cash applications module. Unlike most other small systems that I have reviewed, this system allows printing of a cash applications worksheet. It prints a worksheet for all accounts or selected accounts and provides a convenient means of reconciling amounts received with items recorded in the accounts receivable ledger. Once the worksheet has been completed, it will guide the posting process and serve as

*"If the system fits
you get quite a
bang for a buck."*

hard copy documentation of item key-off decisions.

If a worksheet is not used, the system allows direct inquiry into the accounts affected. If the customer account number is not known, a search routine locates the customer's record. When it locates the customer number, the name of the customer, balance method and payment terms on file are displayed. Because a customer number is required for all cash entries, a miscellaneous customer number should be defined for processing non-receivable collections.

Cash Application Procedures

Cash application procedures for open item and balance forward accounts differ.

The system provides additional screens for open item accounts and an automatic cash application routine. With this routine, the program automatically pays off as many documents as it can, allowing discounts on qualifying documents where applicable. If the total amount received is not enough to cover all documents, then it applies a partial payment to the final document processed. If cash is left over, it is listed as an open credit.

All documents entered; cash, invoices, debit or credit memos, and adjustments, are retained in batch input files. While in this state, they can be altered without affecting the receivable balances. Each file can be printed and compared to input controls before posting. Once they have been posted no change is possible. Only a debit or credit memo may adjust a posted entry.

Unlike other systems, there is no automatic purge of keyed-off items. This means that it returns all entries affecting an account for printing or display on demand and the system will rapidly become choked with completed transactions unless a periodic purge is run. The user has complete control over the purging procedure. First prepare an eligibility report. This report details every eligible item to be purged. Once he makes selection of accounts or dates to be purged, the system user can purge the file or purge the file and print the deleted records.

The accounts receivable module is an impressive bit of work; I am quite eager to see the rest of the order-invoice system. I suspect that in combination they will provide a very useful management information system for progressive business executives. ■

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Most people just sell disks. I sell you a complete system, and then I help you make it work.

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And you buy my telephone number. You see, most of those thousand businesses needed a little help getting their systems up and going, and they called. We answered all their questions, and talked them through their problems. Every time the questions got really tough or really unusual, I'd answer them myself, on the phone, right then and there. I still do.

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I turned the TRS-80 into a serious computer.

The Model I, II and III business systems.

So far, I have six systems for the Model I, at \$99 each:

Accounts Payable	General Ledger
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Invoicing	Inventory Control

For the Cash Journal option on the General Ledger, add \$50.

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General Ledger/Cash Journal	\$ 299
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Additional for Job Costing	100
Inventory Control	399

For the Model III, we offer expanded versions of the six Model I systems, at \$199 each.

Just call the number below and I'll send you any or all of the Model I or Model III systems by return mail. If you call about the Model II, I send you a questionnaire before I'll send you any systems. That lets me individualize the programs to your specific applications.

Why I call them "systems," not "programs."

There's a one-word answer: interaction. Each of the three sets of programs links to the General Ledger, and wherever it's useful, they cross-link to each other. For instance, "Sales Analysis" figures in a salesman's commission rate, so it links to "Payroll." Since it computes profitability within product categories, it links to "Invoicing."

That's what a system is. And that's one big difference between the Taranto TRS-80 business systems and somebody else's collection of business program disks.

If you like, I'll sell you the hardware, too.

I offer the TRS-80, Model II, along with selected peripherals. If you buy the computer from me, you get some extra advantages — hardware that's absolutely tailored to the programs, plus even more hand-holding from Taranto & Associates. The equipment won't cost you any more.

I can sell you a truly serious, completely supported, thoroughly proven business computer system for as little as \$8000, hardware and software both.

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EDUCATION 80

by Earl R. Savage

"Many schools find that magazine subscription sales are their most significant fund-raising activity."

As computers become an increasingly significant part of the daily activities in your school, several difficulties are likely to arise. The first will be getting a sufficient quantity of TRS-80s to meet the growing demand—a tough problem in most districts.

The second difficulty is the ever-present problem of acquiring *good* educational programs in one or many subject fields. Reviews of programs many times are not available resulting all too often in a disappointing purchase. An authoring program as described in the May *Education 80* column can help you write your own programs with a minimum of effort.

Sooner or later you will encounter another difficulty. That is the matter of keeping track of the level of proficiency reached by a growing number of students. When John comes in and asks to use a machine, how can you remember how independently he can function with it? What privileges has he earned? What capabilities has he demonstrated?

In a larger school, especially, this can be a real problem. You can spend a lot of time checking student records—even more in checking with other teachers who may have taught the students. Your best bet is to have a system in which each student carries his own record with him. Here is a description of one such plan.

The system consists of a small wallet-size identification/record card and several programmed instructional courses. It is suitable for use with students of any age.

The front of the student card is shown in Fig. 1. There is a place for a name and an indication of the class of privileges the student has earned. The back of the card

lists available courses and provides spaces for additional ones. Beside each is a place for the date of completion and the instructor's initials.

With this system in place, the student simply presents his card when he wishes to use the computer (and/or to sign up to use it). In addition, the card and its use provide a further degree of student motivation for mastery of the courses.

You will be interested in the qualifying programs used by this particular school as listed on the back of its card. Though the first four were locally developed, they will give you some ideas for your own. Of course, you can use any appropriate programs.

The Programs

The first program course is entitled Keyboard and is designed for the young beginner. The purpose of this interactive sound program is to familiarize the student with the keyboard.

Operation is the title of the second program. It, too, has sound and is interactive. Operation provides linear instruction in using the TRS-80. It covers such topics as List, Break, Continue, Reset, and CLOAD. Upon successful completion of this course, the student should be able to operate the machine independently.

The mechanics of writing elementary programs are presented in the third course, Programming I. The student receives instruction in BASIC through the examination of several simple programs. Among the statements covered are Print, Input, IF...THEN, and FOR...NEXT. There are brief discussions of arithmetic functions and variable types.

The fourth course is Graphics I. It presents the rudiments of graphics—both the Set and block varieties. A bit of animation is thrown in for good measure.

The final two listed programs are Part I and Part II of the Radio Shack Level II BASIC Course.

There you have the list of programs which constitute an informal computer literacy program in one school. If you have another type of system, all of us would like to hear about it.

Micro Funds—Another Source

This is not really another source of microcomputer funds but a source of microcomputers themselves. It comes about because of a recent agreement between Radio Shack and QSP. (QSP is the organization which helps put on school sales of magazines.)

Many schools find that magazine subscription sales are their most significant fund-raising activity. QSP will be offering TRS-80s as premiums for the first time. This is a chance for you and your students to earn computers for your school.

If your school already has a magazine subscription campaign, look into getting TRS-80s as premiums. If magazines sales are permitted in your district but your school does not have them, check on this source of TRS-80s. You can get details from William E. Drake, QSP, Inc., Box 2003, Ridgefield, CT 06877.

Math Games

As you plan your computer purchases for the fall, there are two inexpensive, unusual and very useful programs you should consider. These programs are games which help the students develop certain mathematical skills while they are having fun—painless learning, as it were. The presentation methods along with excellent graphics assure high student motivation.

The Estimation Game develops number sense and estimation skills in whole number computations. The student is presented problems in an unusual way and his estimates are followed through by the computer.

The Distance Game permits the student to attempt to locate a hidden point. With each try, he is given a visual and a mathematical hint. The game may be played in either two or three dimensions; the latter is especially challenging because of the mental imagery required.

Both programs were developed in schools by a mathematics educator. You will find that they are several cuts above the typical math program. They are available from Educational Programs, P.O. Box 2345, West Lafayette, IN 47906. ■

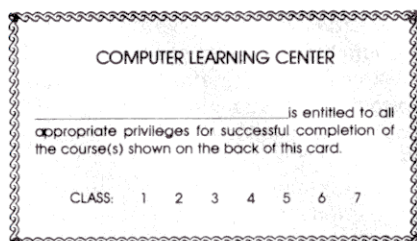


Fig. 1 The Student Identification/Record Card

THE ASSEMBLY LINE

by William Barden, Jr.

"The budget for the Space Shuttle isn't quite comparable to the budget for this column, but this month's topic almost didn't make it for much the same reason..."

Wouldn't it be nice to program without any interface to hardware? I know some of you are heavily into number crunching, but assembly language programmers are exposed to hardware interfacing from time to time. I rose early recently to turn on the TV and watch a piece of hardware that couldn't get off the ground because of an incompatibility between hardware and software. The budget for the Space Shuttle isn't quite comparable to the budget for this column, but this month's topic almost didn't make it for much the same reason—hardware interfacing and a lack of documentation for a hardware glitch!

This month we'll look at that hardware interface and the software that drives it. You can talk directly to your system disk drives with it, bypassing TRSDOS, NEW-DOS and LDOS.

The Shugart SA-400

Many of you have Percom, Pertec, Micropolis and other disk drives. However, the story starts with Shugart, which has become another of those de facto standards. All disk drives look very much like a Shugart SA-400, and we must look at its specifications to see what's involved in disk I/O.

Lest you forget, data is arranged in 35, 40 or 77 tracks, on one or two sides of a diskette. In single density format, the tracks are divided into ten sectors. Each

sector can hold 256 bytes of data, so there are $256 \cdot 10$ or 2560 bytes per track, or $2560 \cdot 35 = 89,600$ bytes of data on a 35-track diskette.

The diskette spins at 300 revolutions per minute, or five revolutions per second. Data passes under the disk head at a rate of $5 \cdot 2650 = 12,800$ bytes per second. A byte of data is available every 78 milliseconds (actually, every 64 milliseconds, as we shall see).

Data is arranged serially on each track,

so that each track is made up of $2560 \cdot 8 = 20,480$ bits in a concentric circle. The physical arrangement is shown in Fig. 1.

A Shugart SA-400 is another dumb device, at least as far as its primary functions. It can be instructed to turn on its motor, to step the head in or out one track, or to write or read a bit. It returns signals representing a sense of the diskette index hole, a track 0 position, and a write protected disk. The SA-400 has a circuit board full of logic to read and write serial data, but the circuitry is not much more sophisticated than that found in a cassette recorder. The signals that go to the SA-400 are shown in Fig. 2.

Disk Formatters and Controllers

Not too long ago, when a computer manufacturer wanted to use a floppy disk drive with his computer, he had to design a disk controller/formatter. This usually involved about 200 medium scale LSI chips acting as an interface from computer to drive.

First, the controller had to convert a byte to a serial bit stream to be sent to the single Write Data line of the disk drive. A similar eight bits had to be assembled from the Read Data line during disk read operations. Since the disk head can only

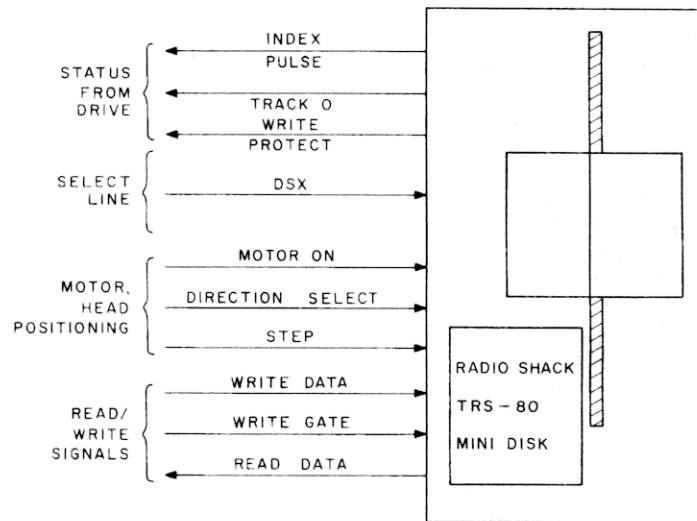


Fig. 2. SA-400 Signals

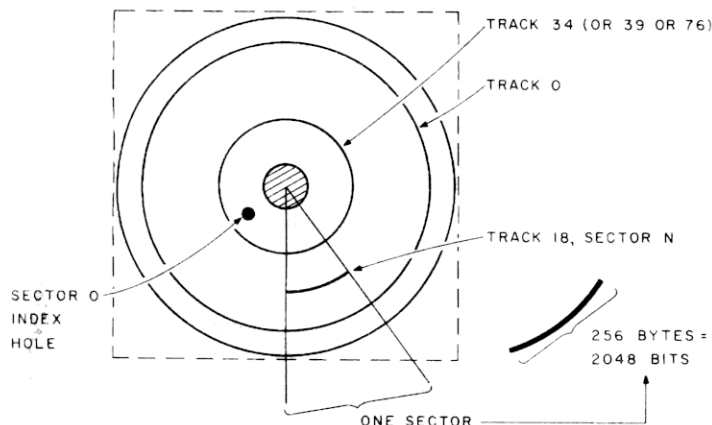


Fig. 1. Physical Format of Diskette

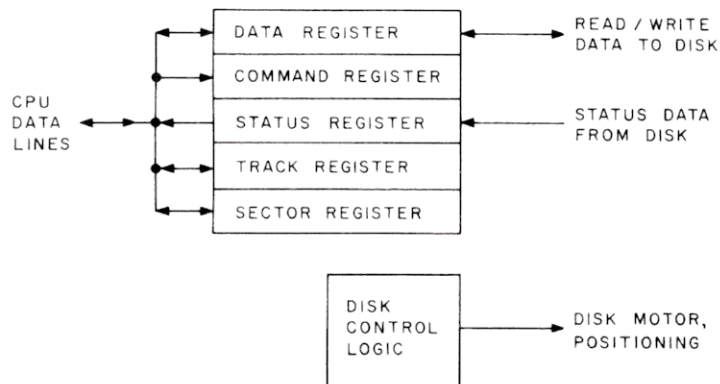


Fig. 3. WD1771 Architecture

be stepped one track at a time, a portion of logic in the controller was devoted to maintaining the location of the current track, and to stepping the disk drive head in and out to find a given track. Another portion of the logic was dedicated to finding a given sector within the track. Other functions included collecting status from the disk sensors. The controller required a clock to time disk actions.

Along with the controller, and usually designed into it, was a formatter. The formatter wrote skeleton tracks onto each diskette. Each skeleton track was divided into sectors, each sector containing an identification (ID) field. This field contained the track and sector number. A data field contained the user data. Special codes were used to mark the start of ID and data fields.

A Single-Chip Disk Controller

Western Digital has a beautiful building off the San Diego Freeway in Orange County, CA. Rumor has it that the second floor landing has a small brass plaque upon which is inscribed, "Dedicated to the 1771 Floppy Disk Formatter/Controller." The 1771 is the single 40-pin LSI chip which replaces those early 200-chip controllers (and presumably 200 design engineers). The 1771 is used in the Model I, and a close relative, the 1793, is used in the

Model III.

The 1771 is really a CPU; it performs the following functions:

- It restores the disk read/write head to track 0.
- It automatically positions the head over a specified track. This is called a seek operation.
- It steps the head in and out one track.
- It steps the head in one track.
- It steps the head out one track.
- It reads a sector's worth of data.
- It writes a sector's worth of data.
- It reads the next identification field of the current track.
- It reads an entire track, including formatting data.
- It writes (formats) an entire track.
- It forces an interrupt.

A twelfth function that the 1771 also performs is returning a status byte that contains information about the disk drive and the success or failure of the current operation.

As the reader can see from the above commands, the 1771 requires some information about the track number and sector number before it can issue some of its commands. In fact, the 1771 contains five eight-bit registers that are accessible from a program. These are the status, command, track, sector and data registers. There are additional registers not ad-

dressable under program control. The most important of these is the data register, which holds eight bits of data to be shifted out serially (write to disk) or eight bits that have been assembled from the disk (read from disk). The general architecture of the 1771 is shown in Fig. 3.

The addresses assigned to the five addressable controller registers in the Model I are 37ECH, 37EDH, 37EDH, 37EEH and 37EFH, respectively, as shown in Table 1. Note that the status and command register share the same address, 37ECH; the status register is addressed for a read 37ECH, while the command register is addressed for a write 37ECH.

Positioning Commands

The first five commands, Restore, Seek, Step, Step In and Step Out, are head positioning commands. Restore steps the head until it is positioned over track zero. The track register does not have to contain a valid track number for Restore to work, and the track register contains a zero at the end of the operation.

The Seek command must be preceded by an output to the data register (37EFH) of the track number for the Seek. In addition, the track register must contain the current head position. This means that Restore must have been performed first, although other head positioning commands could follow Restore.

Step steps the head to the next track in the last used direction. Step In and Step Out also step the head one track.

Some of these commands share functions, and we *could* get by with only Restore and Seek. No data is written to the disk with any of these commands; they are used only to position the head.

The formats for these commands are shown in Table 2. The V bit, or *verify* bit,

RI	RO	msec
0	0	6
0	1	6
1	0	10
1	1	20

ADDRESS	INPUT	OUTPUT	COMMAND	FORMAT	TYPICAL
37ECH	STATUS REG	COMMAND REG	RESTORE	0 0 0 0 0 V RI RO	03H
37EDH	TRACK REG	TRACK REG	SEEK	0 0 0 1 0 V RI RO	13H
37EEH	SECTOR REG	SECTOR REG	STEP	0 0 1 U 0 V RI RO	33H
37EFH	DATA REG	DATA REG	STEP IN	0 1 0 U 0 V RI RO	53H
			STEP OUT	0 1 1 U 0 V RI RO	73H

Table 1. WD177 Controller Addresses

Table 2. Head Positioning Commands

COMMAND	FORMAT	TYPICAL
READ SECTOR	I O O M B I O O	8CH
WRITE SECTOR	I O I M B I O O	ACH

Table 3. Read/Write Sector Commands

COMMAND	FORMAT	TYPICAL
READ ADDRESS	I I O O O I O O	C2H
READ TRACK	I I I O O I O \bar{S}	E4H
WRITE TRACK	I I I I O I O O	F4H

Table 4. Read Address, Read/Write Track Commands

specifies that the track ID will be read and compared with the track register. The R1 and R0 bits define the stepping rate of the head. Some disks are designed to step at a faster rate than the nominal 20 millisecond track-to-track step for the SA-400. (I know you're going to change this rate—just be forewarned that your disk may not be capable of stepping at a faster rate!) Typical settings for the commands are also shown in the table.

Read and Write Sector Commands

The Read sector and Write sector commands are shown in Table 3. They read or write a sector of data. Before a Read or Write command can be given, the head must be positioned over the proper track with a head positioning command, and the sector register must be loaded with the proper sector number by an output to 37EEH. Once this preliminary work is done, the Read or Write sector command is output to 37ECH.

After receiving the Read sector command, the 1771 searches for the ID field that contains the proper sector number. When it finds it, it waits until the data field comes under the head and then starts assembling data bytes into the data register from the serial bit stream. As each byte becomes available, a data request or DRQ flag is set in the status register, and the program can pick up the byte by reading the data register at 37EFH.

Data is transferred from a sector on a byte-by-byte basis in a tight assembly language loop. The loop consists of checking the status (37ECH) for the DRQ bit and performing a read from the data register (37EFH) if data is present. Reading the data register resets the DRQ, and the program loops back again to check for the next byte.

How do we know when to stop? Actual-

ly, we don't have to know when to stop: The 1771 knows how long the data field is from the sector length byte in the ID field of the sector. (For an IBM-type format, 01H in the sector length byte of the ID field specifies 256 bytes of data.) When the 1771 reaches the end of the data file, it resets another bit in the status register, called the busy flag. This flag is normally set to indicate that the 1771 is executing a command; it is reset when the command has been completed. On a Read sector command, the busy flag is reset after the last byte has been assembled and read from the 1771.

On a Write sector command, the process is similar. The head must be correctly positioned over the desired track, and the sector register must contain the proper sector number. The DRQ flag in the status byte is used to signal the program that it must send the next data byte so the 1771 can convert it to a serial bit stream. Sending a byte to the 1771 data register resets the DRQ; the DRQ is set again after the byte has been written on disk. The process continues until the last sector byte has been written, at which time the busy flag bit in the status register is reset.

Going back to the format of the Read and Write sector commands in Table 3, we can see there are some microprogram bits that can be manipulated. The M bit specifies either a single record (0) or multiple records (1). If multiple records are specified, the 1771 will keep transferring data until the end of the track. The normal setting in the Model I is 0, or single record.

The B bit specifies an IBM format (1) or non-IBM format (0). The IBM format refers to a standard sector length of 128, 256, 512 or 1024 bytes per sector. The non-IBM format allows for lengths of 16 to 4096 bytes per sector, provided that the diskette was formatted to one of those sector

lengths.

The A1, A0 bits define which data address mark the 1771 will use. The data address mark is a byte from F8H to FBH that precedes the user data field.

Read Address, Read Track and Write Track Commands

The remaining commands affect portions of the disk that the TRS-80 user never sees. We have talked about formatting a disk, but what is actually involved in the formatting process?

The 1771 uses the Write track command (Table 4) to format a track. One track at a time is formatted, so there must be 35 separate Write track commands to format a 35-track diskette, each one followed by a Step command to move the head to the next track.

The head is first positioned on track 0. A Write track command (F4H) is sent to the command register through an output to 37ECH. At this point the process resembles the Write sector procedure. The 1771 requests the next data byte by the DRQ in the status. The program responds by outputting to 37EFH, which resets the DRQ.

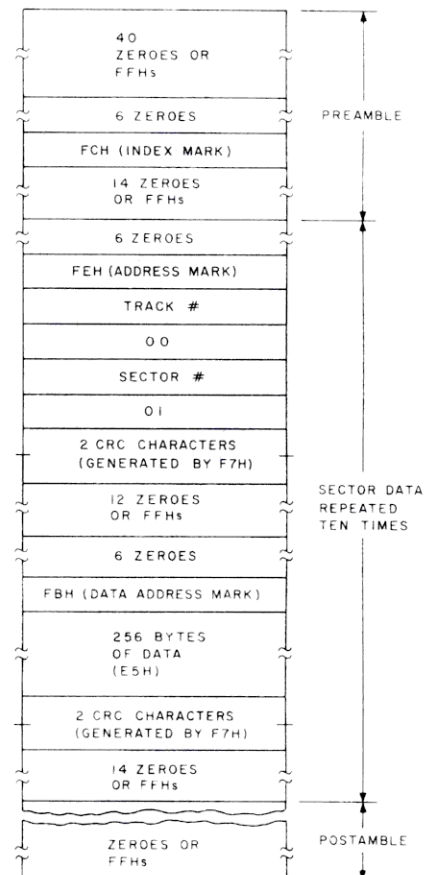


Fig. 4. Formatting Data

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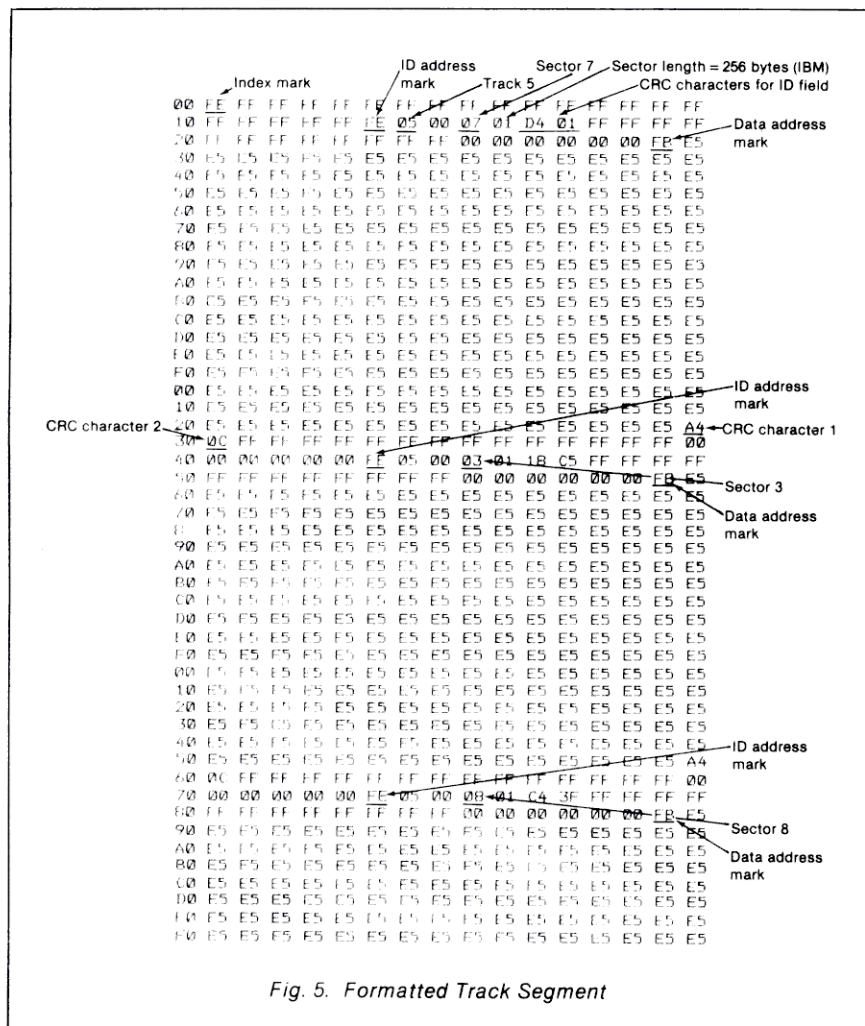


Fig. 5. Formatted Track Segment

The formatting process is done by writing 10 separate blocks of information, for the 10 sectors, for each track formatted. Each block of information consists of the segments shown in Fig. 4. Data is written by the 1771 as soon as it detects the index hole in the diskette.

The program writes a string of 40 zeroes or FFHs, followed by six zeroes. Next, an FCH is written, followed by 14 zeroes or FFHs. This pattern is a preamble that syncs the hardware on subsequent reads. The FCH is used as a sync mark to define the beginning of each track.

It's important to note that any character from F7H through FEH is a special character for the Write track command processing. A character in this range causes a special hardware action in the 1771.

After the preamble, the data for 10 sectors is output. The first six bytes constitute a leader made up of zeroes. The next byte is the special hardware character of FEH. This character is an ID address mark that identifies the beginning of the identi-

fication field. The identification field follows. Five bytes are output, but six bytes are actually generated in the field. The track number, zeroes, sector number and sector length (one for the IBM format of 256 bytes, multiples of 16 for non-IBM formats) are all written on the track. The next byte is the special character F7H, which causes two CRC characters to be written to the disk. The CRC (Cyclical Redundancy Check) characters are checksums of the ID field data.

The ID field data is followed by a program output of 12 zeroes or FFHs, followed by six zeroes, followed by the special character FBH. FBH is a data address mark which identifies the beginning of the user data area.

The user data area is reserved for the 256 bytes of sector data (IBM-type format with sector length of 01H) that we normally associate with a disk sector. In the formatting process, no meaningful data is output, but some non-conflicting data, such as E5H, is written instead. By non-conflict-

ing, I mean any data except for the special hardware codes of F7H through FEH.

After 256 bytes of E5Hs are output (or multiples of 16 bytes for non-IBM format), the formatting program outputs an F7H which causes two CRC bytes to be generated. These bytes are a checksum of the data field. Finally, 14 zeroes or FFHs are written as a trailer in the sector.

This process is repeated nine times to make up the 10 sectors of the track. After the last sector has been written, zeroes or FFHs are written until the 1771 busy bit is reset (index mark detected again).

Fig. 5 shows a partial track of data after formatting. The data starts with the FCH index mark and continues for two and one-half sectors or so.

One interesting point about the tracks is that the sectors do not follow each other sequentially. Instead of sectors 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 on the disk, we find 0, 5, 1, 6, 2, 7, 3, 8, 4, 9! The reason for this strange arrangement is that the sectors have been optimized, to allow for some processing between the next sector in sequence. For similar reasons, the tracks do not necessarily start with sector 0.

The Read address command reads the next ID field on the current track. The six bytes of the ID field are read in an operation identical to the Read sector operation, except that the busy flag bit is reset after the six bytes have been read.

The Read track and Write track commands result in operations identical to the Read and Write sector commands, except that the entire track, and not just the data field, is read or written. The Write data command initiates the formatting sequence. The S bar bit in the Read track command is used to synchronize the reading of data to each address mark (0) or to simply read in data (1).

Force Interrupt

The last command can be used to terminate the current 1771 operation upon attaining a specified condition. It would never be used on the Model I. The term interrupt does, in fact, refer to an interrupt from the 1771 to the Model I, but the disk operations in the Model I are not interrupt driven.

Status

The status register at 37ECH holds status dependent upon the current command in progress, as shown in Table 5.

Bit 0 is always a busy flag bit, set to one when a 1771 operation is in progress, and to zero when the operation is over. Likewise, bit 7, Not RDY, is set when the disk drive is not ready.

Write protect is a direct reading from

the write protect notch sensor. (If the notch is covered, the disk is write protected.) The Record type during a Read is the actual data address mark encountered in the data field. Write fault and CRC error indicates errors in reading or writing data.

Track 0 indicates that the head is over track zero. Index indicates that the index hole is passing under the sensor. Lost data indicates that the program could not keep up with the data transfer. During a write procedure, this means the program didn't present the next data byte in time to write it at the next point on the track; during a read, it means the next byte filled the data register before the program read in the previous byte. Either one is a catastrophic condition.

We mentioned earlier that data is transferred at a rate of one byte every 64 microseconds. This figure is derived from the rotational speed of the disk and the amount of data (including format data) on a track. If we assume that each Model I instruction takes five microseconds, we can execute about 13 instructions in a read or write disk loop! It doesn't take too much overhead to fall behind—if the real-time clock interrupts are enabled, this puts additional processing in the loop as the code for the real-time clock routine is entered. It's important, therefore, to keep the DRQ loop very tight to avoid missing data.

A Disk Driver Program

You're now ready to use a disk driver program, which I have aptly named DSKDRV (see Program Listing 1). DSKDRV enables you to read disk status, to read and write a sector, to read the ID field, and to read and write a track. The latter function would allow you to format a track if you have a buffer full of data.

DSKDRV is called with HL pointing to a parameter block that defines the disk parameters to be used. If you are calling this program from BASIC, note that it is not relocatable. If you are not calling DSKDRV from BASIC, NOP the three bytes at F009H, AH and BH with three 00Hs, or reassemble with the Call 0A7FH deleted. I would not advise using this on your non-disk Level II system.

The parameter block is shown in Fig. 6. The first byte is the function code. The next two bytes are the sector and track numbers. The final two bytes are the buffer address for reads and writes. This address, of course, is in standard Z-80 format with least significant byte followed by most significant byte. PARAM + 5 is the type of completion and PARAM + 6 is the status after completion. Both of these bytes are used to return data to the calling program.

BIT POS'N	7	6	5	4	3	2	1	0
HEAD POSITION	NOT RDY	WRITE PROT	HEAD EN-GAGED	SEEK ERROR	CRC ERROR	TRK 0	INDEX	BUSY
READ SECTOR		REC TYPE	REC TYPE	REC NOT FOUND		LOST DATA	DRQ	
WRITE SECTOR		WRITE PROT	WRITE FAULT	REC NOT FOUND				
READ ADDRESS		0	0	ID NOT FOUND				
READ TRACK		0	0	0	0			
WRITE TRACK		WRITE PROT	WRITE FAULT	0	0			

Table 5. Status for Commands

Program Listing 1. DSKDRV

```

F000      00100      ORG      0F000H      ;***CHANGE THIS***
00110 ;*****
00120 ;* DISK DRIVER. CHECKS DISK STATUS, POSITIONS HEAD, *
00130 ;* READS AND WRITES SECTORS, READS ID, READS AND WRITES *
00140 ;* TRACKS. *
00150 ;* CALLING SEQUENCE: HL=> PARAMETER BLOCK *
00160 ;* PARAM+0: FUNCTION: 0=RD STATUS, 1=POSITION *
00170 ;* HEAD, 2=READ SECTOR, 3=WRITE SECTOR, *
00180 ;* 4=READ ID DATA, 5=READ TRACK, 6=WRITE *
00190 ;* TRACK *
00200 ;* PARAM+1: SECTOR NUMBER *
00210 ;* PARAM+2: TRACK NUMBER *
00220 ;* PARAM+3,+4: BUFFER ADDRESS *
00230 ;* PARAM+5: TYPE COMPLETION: 0=OK, 1=POSITION *
00240 ;* ERROR, 2=READ/WRITE ERROR *
00250 ;* PARAM+6: LAST STATUS OR STATUS OF FAILURE *
00260 ;* PARAM+7: BIT 7:0=NO WAIT, 1=WAIT BITS 6-0: *
00270 ;* DRIVE NUMBER *
00280 ;*****
00290 ;
F000 F3      00300      DSKDRV DI          ;DISABLE INTERRUPTS
F001 F5      00310      PUSH AF          ;SAVE REGISTERS
F002 C5      00320      PUSH BC
F003 D5      00330      PUSH DE
F004 E5      00340      PUSH HL
F005 DDE5    00350      PUSH IX
F007 FDE5    00360      PUSH IY
F009 CD7F0A  00370      CALL 0A7FH      ;***GET PB LOC'N***
F00C E5      00380      PUSH HL          ;TRANSFER TO IX
F00D DDE1    00390      POP IX
F00F AF      00400      XOR A            ;ZERO A
F010 DD7705  00410      LD (IX+5),A      ;ZERO TYPE COMPLETION
F013 DD7706  00420      LD (IX+6),A      ;ZERO STATUS
F016 DD7E07  00430      LD A,(IX+7)      ;GET DRIVE #
F019 E603    00440      AND 3            ;MASK OUT WAIT BIT
F01B 3C      00450      INC A            ;0-3 BECOMES 1-4
F01C 47      00460      LD B,A          ;NOW IN B
F01D 3E80    00470      LD A,80H        ;BIT FOR SELECT
F01F 07      00480      DSK010 RLCA      ;ALIGN
F020 10FD    00490      DJNZ DSK010     ;CONVERT TO POSIITON
F022 32E037  00500      LD (37E0H),A    ;SELECT DRIVE
F025 DDCB077E 00510      BIT 7,(IX+7)    ;TEST WAIT BIT
F029 2809    00520      JR Z,DSK030     ;GO IF NO WAIT
F02B 210000  00530      LD HL,0         ;WAIT COUNT
F02E 25      00540      DSK020 DEC H      ;DECREMENT COUNT
F02F 20FD    00550      JR NZ,DSK020    ;GO IF NOT 0
F031 2D      00560      DEC L            ;DECREMENT COUNT LSB
F032 20FA    00570      JR NZ,DSK020    ;GO IF NOT 0
F034 3AEC37  00580      DSK030 LD A,(37E0H) ;GET STATUS
F037 0F      00590      RRCA            ;TEST BUSY
F038 38FA    00600      JR C,DSK030     ;GO IF BUSY
F03A FD210000 00610      LD IY,0        ;FOR MULTIPLICATION
F03E DD4E00  00620      LD C,(IX+0)    ;GET FUNCTION
F041 0600    00630      LD B,0         ;NOW IN BC
F043 FD09    00640      ADD IY,BC       ;FUNCTION*1
F045 FD09    00650      ADD IY,BC       ;FUNCTION*2
F047 FD09    00660      ADD IY,BC       ;FUNCTION*3
F049 01DCF0  00670      LD BC,FTAB     ;FUNCTION TABLE ADDRESS

```

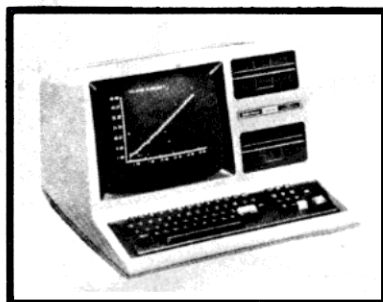
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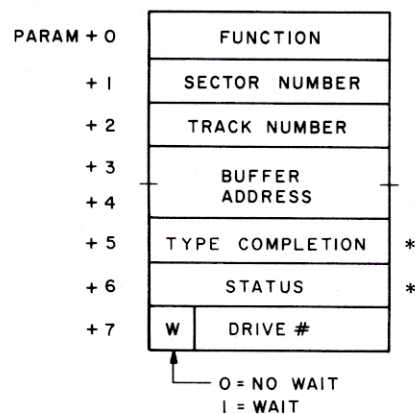
THE ASSEMBLY LINE

PARAM + 7 contains the drive numbers. The most significant bit of this byte is set to one if a pause is to occur before the disk is accessed, or to a zero if no pause is to occur. The disk is spinning only when it is accessed. It takes about a second to bring the disk up to speed for read and write operations. Before any disk operation is performed, a disk must be selected and brought up to speed. If no further operations are done, the disk will turn off after about three seconds. As long as the disk is spinning and consecutive disk operations are being done, there is no need to wait. However, if no operation has yet been done, or if the disk has turned off, the wait bit should be on.

DSKDRV Structure

DSKDRV flows from beginning to end (don't laugh—a lot of programs don't). In a concession to structured programming advocates, there are no computed GOTOS.

The order of operations are: Select a drive; position head if necessary; output to sector register if necessary; read or write if



* SUPPLIED ON RETURN

Fig. 6. DSKDRV Parameter Block Input

```

F04C FD09 00680 ADD IY,BC ;POINT TO ENTRY
F04E FD4E00 00690 LD C,(IY+0) ;GET COMMAND
F051 FD4601 00700 LD B,(IY+1) ;GET SEQUENCE
F054 FD5E02 00710 LD E,(IY+2) ;GET STATUS MASK
F057 CB40 00720 BIT 0,B ;CHECK TRACK BIT
F059 282A 00730 JR Z,DSK070 ;GO IF NO TRACK ACTION
F05B DD7E02 00740 LD A,(IX+2) ;GET TRACK NUMBER
F05E B7 00750 OR A ;TEST FOR ZERO
F05F 2004 00760 JR NZ,DSK040 ;GO IF NOT RESTORE
F061 3E03 00770 LD A,3 ;RESTORE COMMAND
F063 1807 00780 JR DSK050 ;GO TO RESTORE
F065 32EF37 00790 LD (37EFH),A ;OUTPUT TRACK #
F068 D5 00800 PUSH DE ;WASTE TIME
F069 D1 00810 POP DE
F06A 3E17 00820 LD A,17H ;SEEK COMMAND
F06C 32EC37 00830 LD (37ECH),A ;OUTPUT RESTORE OR SEEK
F06F D5 00840 PUSH DE ;WASTE TIME
F070 D1 00850 POP DE
F071 D5 00860 PUSH DE
F072 D1 00870 POP DE
F073 3AEC37 00880 DSK060 LD A,(37ECH) ;GET STATUS
F076 0F 00890 RRCA ;TEST BUSY
F077 38FA 00900 JR C,DSK060 ;LOOP IF BUSY
F079 07 00910 RLCA ;RESTORE STATUS
F07A DD7706 00920 LD (IX+6),A ;STORE STATUS
F07D E698 00930 AND 98H ;TEST STATUS
F07F 2804 00940 JR Z,DSK070 ;GO IF OK
F081 3E01 00950 LD A,1 ;POSITION ERROR FLAG
F083 184B 00960 JR DSK120 ;GO TO STORE
F085 CB48 00970 DSK070 BIT 1,B ;GET SECTOR BIT
F087 2808 00980 JR Z,DSK080 ;GO IF NO SECTOR ACTION
F089 DD7E01 00990 LD A,(IX+1) ;GET SECTOR
F08C 32EE37 01000 LD (37EEH),A ;OUTPUT TO SECTOR REGISTER
F08F D5 01010 PUSH DE ;WASTE TIME
F090 D1 01020 POP DE
F091 CB50 01030 DSK080 BIT 2,B ;GET READ/WRITE BIT
F093 D5 01040 PUSH DE ;SAVE STATUS CHECK BITS
F094 282E 01050 JR Z,DSK110 ;GO IF NO READ/WRITE ACTION
F096 79 01060 LD A,C ;GET COMMAND
F097 DD5E03 01070 LD E,(IX+3) ;GET BUFFER ADDRESS
F09A DD5604 01080 LD D,(IX+4)
F09D 21EC37 01090 LD HL,37ECH ;STATUS REGISTER ADDRESS
F0A0 77 01100 LD (HL),A ;OUTPUT COMMAND
F0A1 CB58 01110 BIT 3,B ;TEST READ/WRITE TYPE
F0A3 D5 01120 PUSH DE ;WASTE TIME
F0A4 D1 01130 POP DE
F0A5 D5 01140 PUSH DE
F0A6 D1 01150 POP DE
F0A7 01EF37 01160 LD BC,37EFH ;DATA REGISTER ADDRESS
F0AA 280C 01170 JR Z,DSK100 ;GO IF READ
F0AC 7E 01180 DSK090 LD A,(HL) ;GET STATUS
F0AD 0F 01190 RRCA ;BUSY TO C
F0AE 3014 01200 JR NC,DSK110 ;GO IF DONE
F0B0 0F 01210 RRCA ;DRQ TO C
F0B1 30F9 01220 JR NC,DSK090 ;GO IF NOT READY

```

Program continues

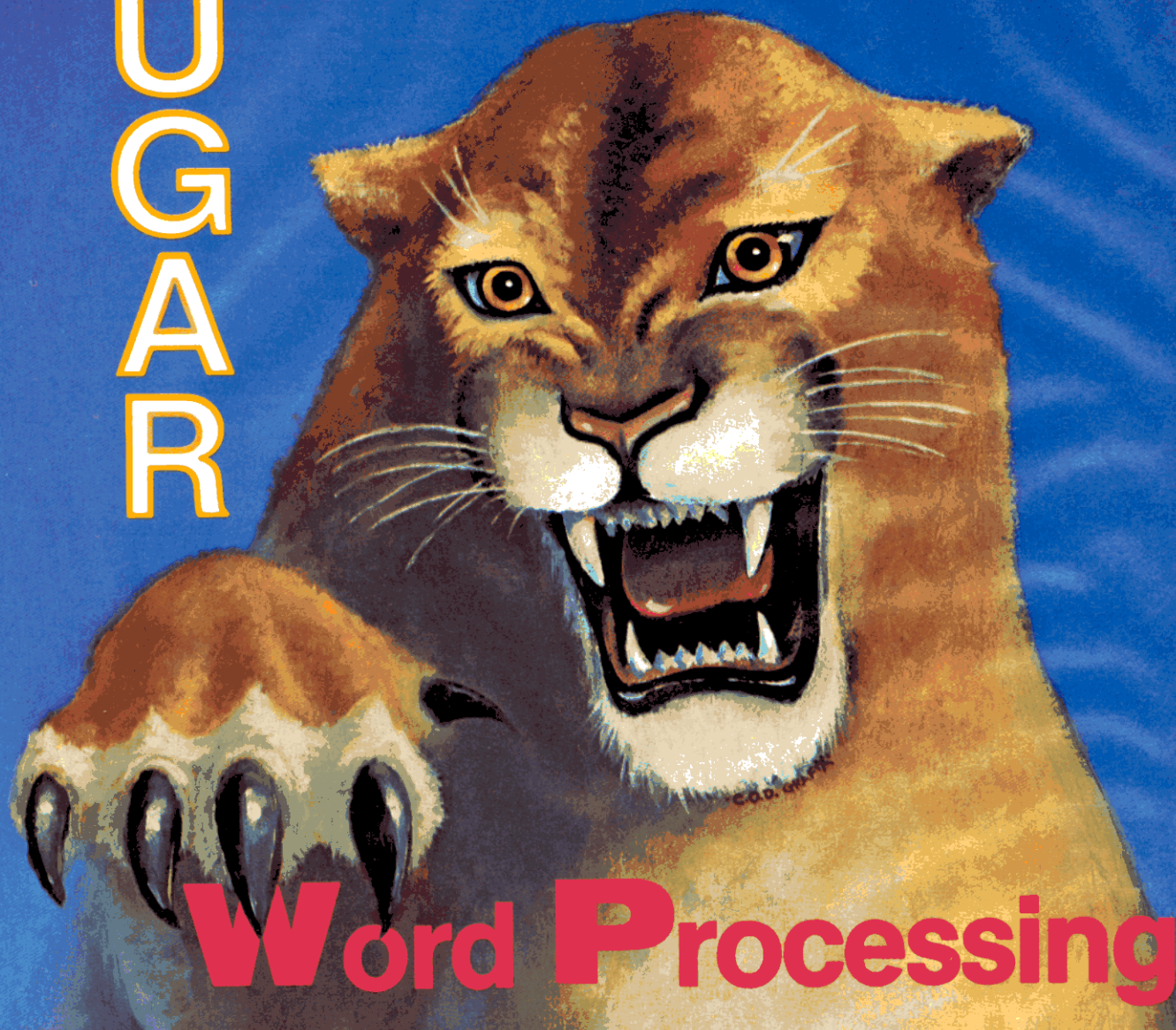
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```

F0B3 1A      01230      LD      A,(DE)      ;GET BYTE
F0B4 02      01240      LD      (BC),A      ;OUTPUT TO DISK
F0B5 13      01250      INC      DE          ;BUMP MEMORY POINTER
F0B6 1BF4     01260      JR      DSK090      ;GO FOR NEXT
F0B8 7E      01270      LD      A,(HL)      ;GET STATUS
F0B9 0F      01280      RRCA          ;BUSY TO C
F0BA 3008     01290      JR      NC,DSK110   ;GO IF DONE
F0BC 0F      01300      RRCA          ;DRQ TO C
F0BD 30F9     01310      JR      NC,DSK100   ;GO IF NOT READY
F0BF 0A      01320      LD      A,(BC)      ;GET BYTE
F0C0 12      01330      LD      (DE),A      ;STORE
F0C1 13      01340      INC      DE          ;BUMP MEMORY POINTER
F0C2 1BF4     01350      JR      DSK100      ;GO FOR NEXT
F0C4 3AEC37   01360      LD      A,(37ECH)   ;GET STATUS
F0C7 DD7706   01370      LD      (IX+6),A    ;STORE
F0CA C1      01380      POP      BC          ;RESTORE MASK BITS
F0CB A1      01390      AND      C          ;TEST
F0CC 2805     01400      JR      Z,DSK130    ;GO IF OK
F0CE 3E02     01410      LD      A,2        ;ERROR CODE
F0D0 DD7705   01420      LD      (IX+5),A    ;STORE IN COMPLETION TYPE
F0D3 FDE1     01430      POP      IX         ;RESTORE REGISTERS
F0D5 DDE1     01440      POP      IX
F0D7 E1      01450      POP      HL
F0D8 D1      01460      POP      DE
F0D9 C1      01470      POP      BC
F0DA F1      01480      POP      AF
F0DB C9      01490      RET                ;RETURN TO CALLING PROG
F0DC 01500    EQU      S                  ;FUNCTION TABLE
F0DC 0000     01510      DEFW      0000H
F0DE 00      01520      DEFB      0
F0DF 0001     01530      DEFW      0100H
F0E1 18      01540      DEFB      18H
F0E2 8C07     01550      DEFW      078CH
F0E4 1C      01560      DEFB      1CH
F0E5 AC0F     01570      DEFW      0FACH
F0E7 7C      01580      DEFB      7CH
F0E8 C405     01590      DEFW      05C4H
F0EA 1C      01600      DEFB      1CH
F0EB E405     01610      DEFW      05E4H
F0ED 04      01620      DEFB      04H
F0EE F40D     01630      DEFW      0DF4H
F0F0 44      01640      DEFB      44H
0000      01650      END

```

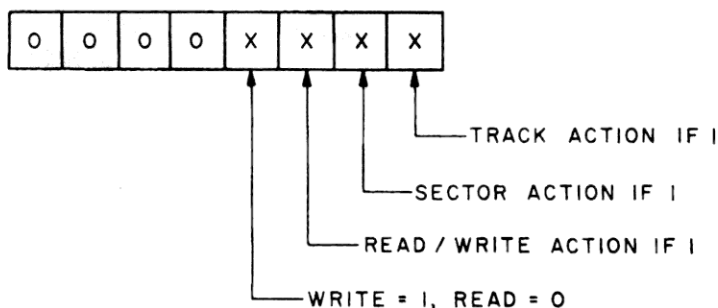


Fig. 7. DSKDRV Sequence Code

necessary; and get status.

First the interrupts are turned off and the registers saved. A Call is made to 0A7FH to get the address of the parameter block. Next, the completion type and status are zeroed.

At about DSK010, the drive number is picked up from PARAM + 7. A possible wait bit is masked out by AND 3. The drive number must be converted to 01H, 02H, 04H or 08H so the proper drive may be selected by an output to address 37E0H. Outputting to this address loads a four-bit latch in the expansion interface and turns on a one shot for about three seconds. The four select lines on the disk cable connect to the latch, and the one correspond-

ing to the drive number will be low after the LD (37E0H),A instruction.

The conversion from zero through three to a bit position is handled by shifting 80H left the number of times corresponding to the drive number. After the drive has been selected, the wait bit is tested. If a wait is specified, a time delay of 65,536 counts is performed at DSK020.

The loop at DSK030 tests the busy status of the disk by reading the status register at 37ECH. If the disk is not busy, the loop falls through.

The code from this point up to DSK040 accesses a function table called FTAB based on the function in PARAM + 0. Each entry in the function table is made up of

three bytes. The first byte is a sequence code for the function, the second is the principal command for the function, and the third is a status mask.

The sequence code is shown in Fig. 7. The four lower-order bits define operations for track action, sector action, read/write action and read/write function. They are a type of microcoding for operations in DSKDRV. As an example, the sequence code for Write track is 0DH, specifying head positioning over a track, no sector action, and read/write action with a write.

The command for the function is the actual command to be output. The status byte is, in fact, a mask byte. When the final status is obtained, this value can be ANDed with the final status, and if any one bit falls through, an error has occurred. The sequence, command and status mask are put in B, C and E, respectively.

The code before DSK040 checks for track action in the sequence byte by: BIT 0,B. If track action is called for, the track number from PARAM + 2 is loaded. If this track number is a zero, a Restore function is done; if non-zero, a Seek function is done. The track number is loaded into the data register at DSK040 for a Seek. At DSK050, the Seek or Restore command is output.

That status loop at DSK060 loops until the Seek or Restore operation has terminated (busy reset). The status is then stored in PARAM + 6, and a check is made of the validity of the Seek or Restore action. If any bit represented by 98H is on in the status byte, an error Seek or Restore has occurred, a type completion of 1 is stored in PARAM + 5, and an abnormal return is made.

If everything is proper, DSK070 tests the sector action. If sector action is called for (BIT 1,B), the sector number is picked up from PARAM + 1, and an output is made to the sector register at 37EEH.

The code at DSK080 tests the read/write action (BIT 2,B). If there is to be a read or write, the command from C is output to the command register by: LD (HL),A. The buffer address is put into DE and the data register address into BC; this allows for a tight read/write loop.

Next, bit three of the sequence byte is checked to determine whether the action is to be a read or write. A write action occurs at DSK090, while a read occurs at DSK100. In both cases, the busy bit is tested first to see if the last byte of the action has been transferred. If not, the DRQ bit is tested to see if the 1771 is ready for the next byte (write) or if it has the next byte (read). As the length of the operation is implicit in the command, no check must be made of the number of bytes transferred

by the program.

At the end of the read or write, the busy flag is reset and DSK110 is entered. The final status is read from the status register by: LD A,(37ECH). This status is ANDed with the status mask; if the one-bit is set in the result, an abnormal type 2 comple-

tion has occurred, and this code is stored in PARAM + 5. Otherwise, the zero initially put in the completion type remains on the return to the calling program.

How to Use DSKDRV

Not all the 1771 commands are used in

```

20 'DISK DRIVER DRIVER
40 DEFUSR0=&HF000
60 CLS
80 INPUT "INPUT FUNCTION: 0=RD STATUS 1=POSITION HEAD 2=READ SEC
TOR
3=WRITE SECTOR 4=READ ID DATA 5=READ TRACK 6=WRITE TRACK";F
100 IF F<0 OR F>6 GOTO 80
120 POKE 61432-65536,F
140 IF F<>0 GOTO 240
160 GOSUB 460
180 A=USR0(61432-65536)
200 GOSUB 860
220 GOTO 80
240 IF F<>1 GOTO 340
260 GOSUB 460:GOSUB 680
280 A=USR0(61432-65536)
300 GOSUB 860
320 GOTO 80
340 GOSUB 460:GOSUB 600:GOSUB 680:GOSUB 760
360 A=USR0(61432-65536)
380 GOSUB 860
400 IF F=2 OR F=3 THEN L=256 ELSE IF F=4 THEN L=6
ELSE L=3000
420 I=B:J=B+L-1:GOSUB 940
440 GOTO 80
460 INPUT "DRIVE #";D
480 IF D<0 OR D>3 GOTO 460
500 INPUT "WAIT(W) OR NO WAIT(N)";WS
520 IF WS<>"W" AND WS<>"N" GOTO 500
540 IF WS="W" THEN D=D+128
560 POKE 61439-65536,D
580 RETURN
600 INPUT "SECTOR #";S
620 IF S<0 OR S>9 GOTO 600
640 POKE 61433-65536,S
660 RETURN
680 INPUT "TRACK #";T
700 IF T<0 OR T>39 GOTO 680
720 POKE 61434-65536,T
740 RETURN
760 INPUT "BUFFER ADDRESS";B
780 IF B<0 OR B>61431 GOTO 760
800 POKE 61435-65536,B-INT(B/256)*256
820 POKE 61436-65536,INT(B/256)
840 RETURN
860 PRINT "COMPLETION=";PEEK(61437-65536)
880 PRINT "STATUS=";PEEK(61438-65536)
900 FOR I=0 TO 300:NEXT I
920 RETURN
940 M=0
960 FOR K=I TO J
980 IF M<>INT(M/16)*16 GOTO 1040
1000 IF M=256 THEN M=0
1020 L=M:GOSUB 1180
1040 IF K>32768 THEN L=PEEK(K-65536) ELSE L=PEEK(K)
1060 GOSUB 1180
1080 M=M+1:IF M=INT(M/16)*16 THEN PRINT
1100 IF INKEY$<>" " GOTO 1140
1120 NEXT K
1140 PRINT
1160 RETURN
1180 L1=INT(L/16):L2=L-L1*16
1200 IF L1<10 THEN PRINT CHR$(L1+48); ELSE PRINT CHR$(L1+55);
1220 IF L2<10 THEN PRINT CHR$(L2+48); ELSE PRINT CHR$(L2+55);
1240 PRINT " ";
1260 RETURN

```

Program Listing 2. Disk Driver Driver

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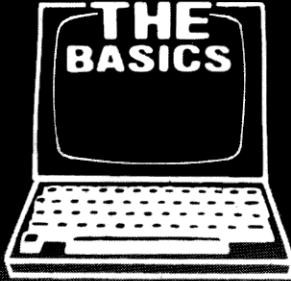
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THE ASSEMBLY LINE

```
INPUT FUNCTION: 0=RD STATUS 1=POSITION HEAD 2=READ SECTOR
3=WRITE SECTOR 4=READ ID DATA 5=READ TRACK 6=WRITE TRACK? 0
DRIVE #? 0
WAIT(W) OR NO WAIT(N)? W
COMPLETION= 0
STATUS= 0
INPUT FUNCTION: 0=RD STATUS 1=POSITION HEAD 2=READ SECTOR
3=WRITE SECTOR 4=READ ID DATA 5=READ TRACK 6=WRITE TRACK?
BREAK IN 80
READY
>CMD"P"
```

Fig. 8. Disk Driver Screen Dialog

```
INPUT FUNCTION: 0=RD STATUS 1=POSITION HEAD 2=READ SECTOR
3=WRITE SECTOR 4=READ ID DATA 5=READ TRACK 6=WRITE TRACK? 4
DRIVE #? 0
WAIT(W) OR NO WAIT(N)? W
SECTOR #? 0
TRACK #? 5
BUFFER ADDRESS? 40000
COMPLETION= 0
STATUS= 0
00 05 00 09 01 F7 0E
INPUT FUNCTION: 0=RD STATUS 1=POSITION HEAD 2=READ SECTOR
3=WRITE SECTOR 4=READ ID DATA 5=READ TRACK 6=WRITE TRACK?
BREAK IN 80
READY
>CMD"P"
```

Fig. 9. Read ID Function Screen Dialog

DSKDRV. As the Step, Step In and Step Out commands are somewhat redundant with Seek, only Seek (and Restore) are used in DSKDRV. DSKDRV, however, can be used to perform virtually any disk operation performed in the DOSes.

If you are operating with a properly formatted diskette, you will have no problem reading or writing to any sector on the disk. Reading a track is also no problem. You should experiment with the Write track for some time before trying this function on your 2000-name mailing list, however.

Program Listing 2 is designed to give you some experience using DSKDRV. The BASIC program is called Disk Driver Driver and makes it somewhat easier to interface to DSKDRV than Debug or another assembly language program. Disk Driver uses a parameter block area at locations OEFFOH, so be certain to protect memory above that point by answering the memory size question as 61423.

Fig. 8 shows the sample output from Disk Driver Driver. The program first asks for the function to be performed. The code corresponds to the function codes in DSKDRV. Next, the drive number and wait bit status are requested. In this case, the function was simply to read the status, and the program returned the completion type of zero and status of zero.

A sample display for a read ID function is shown in Fig. 9. In this case the sector and track numbers were also requested. Disk Driver Driver always asks for the sector number for a read or write, even though, as in this case, it is not required.

The buffer address can be any address not in use by BASIC, and capable of storing 3000 bytes or so for the read track function. Any read or write operation is followed by completion type and status and the contents of the buffer. The buffer contents printout can be stopped by pressing any key (except shift).

In an earlier figure we saw the appearance of a track directly after formatting. Fig. 10 shows the printout of the same track with data. The first column of the display is the displacement from the start of the buffer in hexadecimal. This value cycles from 00H through FFH and then back to zero again.

Fig. 11 shows the display resulting from a Read sector function. This is the third sector of the directory. While Disk Driver Driver is no Superzap in its sector displays, it will let you look at any sector on the disk. Furthermore, it lets you look at any track to investigate strange formatting or other secrets.

The Strange Case of Lost Data

Now to get back to the glitch I men-

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THE ASSEMBLY LINE

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10	F	F	F	F	F	F	F	05	00	07	01	D	F	01	F	F	F	F	F
20	F	F	F	F	F	F	F	00	00	00	00	00	00	00	00	00	00	00	00
30	80							00	00	00	00	00	00	00	00	00	00	00	00
40	57	7D	1F	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
50	7A	1C	1F	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
60	20	44	49	53	48	20	42	41	53	49									
70	40	42	45	52	20	20	20	20	56	54	20	32	3E	31	31	20	2A		
80	2A	0D	00	20	20	20	20	20	20	20	20	4C	69	63	63	6E	73		
90	63	6A	20	74	6F	20	4C	6F	62	6F	20	44	72	69	70	76	65		
A0	75	24	49	6E	74	27	6C	2E	31	39	38	31	38	31	00	20	00		
B0	20	20	20	20	20	20	28	63	29	20	63	6F	70	79	72	69	67		
C0	6B	74	20	31	39	38	30	30	62	79	20	4C	61	61	6E	63	65		
D0	20	40	69	63	6B	6C	75	73	20	20	49	6E	63	6E	00	20	00		
E0	20	20	20	20	20	20	42	75	72	6C	69	6E	67	74	74	6F	6E		
F0	20	20	56	74	2E	30	33	30	34	31	20	20	20	20	41	60	65		
00	6C	20	72	69	67	68	74	73	20	72	65	73	65	72	76	65			
10	64	00	00	00	43	68	65	63	68	69	6E	67	70	66	6F	72			
20	20	65	72	72	6F	72	73	00	00	42	61	64	20	05	D4	6F			
30	7F	FF	FF	FF	FF	FF	FF	00	00	FF	FF	FF	FF	FF	FF	00	00		
40	00	00	00	00	00	00	00	05	00	03	01	18	C5	FF	FF	FF	FF		
50	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	28	33		
60	45	43	48	29	09	20	3B	47	45	54	20	53	54	41	54				
70	55	53	00	80	80	85	89	80	20	09	52	52	43	41	09	09	00		
80	09	20	20	38	54	54	53	54	20	42	55	53	59	00	80	80	80		
90	B6	80	80	20	09	4A	52	09	43	20	44	53	48	30	33	30			
A0	09	20	20	38	47	4F	20	49	46	20	42	55	53	59	00	80	80		
B0	80	B6	B1	80	20	09	4C	54	09	49	59	20	30	09	09	00	3B		
C0	46	4F	5E	52	20	40	55	4C	54	49	50	4C	49	43	41	54	49		
D0	4F	4E	00	80	80	B6	B2	80	20	09	4C	44	09	43	20	28	00		
E0	49	58	28	30															

Fig. 10. Track Section with Data

Displacement from start of buffer.

0	50	00	00	00	00	44	49	52	20	20	20	53	59	53
10	20	02	96	42	0A	00	11	01	FF	FF	00	00	00	00
20	5F	03	D9	54	00	53	59	33	37	20	20	20	53	59
30	20	02	52	C3	22	00	21	22	02	23	FF	FF	FF	FF
40	80	20	00	00	00	00	00	00	00	00	00	00	00	00
50	00	00	00	00	00	00	00	22	FF	FF	FF	FF	FF	FF
60	15	03	D9	03	00	4B	53	40	20	20	20	20	46	44
70	F3	40	96	42	02	00	1A	00	FF	FF	FF	FF	FF	FF
80	10	44	89	00	00	44	53	48	44	52	56	20	4F	42
90	96	42	96	42	02	00	00	00	FF	FF	FF	FF	FF	FF
A0	06	03	D9	50	40	43	4F	40	40	20	20	43	40	44
B0	00	5F	96	42	07	00	1A	21	FF	FF	FF	FF	FF	FF
C0	1E	03	D9	10	43	00	44	44	46	49	4C	45	20	43
D0	00	5F	96	42	0C	00	1B	20	10	01	FF	FF	FF	FF
E0	05	03	D9	A4	00	5E	32	33	32	4C	20	20	44	56
F0	F3	40	96	42	04	00	1A	00	FF	FF	FF	FF	FF	FF

Fig. 11. Read Sector Display

tioned at the first part of this column. Using DSKDRV, I consistently got a Lost Data status for the Read track function. The data itself, however, looked valid. Checking around, I happened to talk to Bill Schroeder of Galactic Software. He suggested I talk to one of their people, Tim Mann, the resident 1771 expert. Before I could even describe the problem completely, he said, "Yes, on Read track I noticed that I was consistently getting a Lost Data message. I suspect there is an error in the 1771." Perhaps one of you can define under what conditions the Lost Data message appears. Is there an error in the 1771 logic? Or is it programmer error?

If you can ferret out the answer, you'll be mentioned in dispatches in this column.

...And Speaking of Programmer Error

I did it again. Another error in a column. (For my only previous error please look at the April, 1923, column of *80 Microcomputing*, where I discussed punched cards.) In the March column, marking should read spacing and vice versa. Thanks to Charles A. King of Techplan Corporation, Falls Church, VA. for this.

That's it until next month. Thanks for all your comments and suggestions on the column. ■



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80 APPLICATIONS

by Dennis Kitz

"...I knew that time was short for me and my Model I... But in parting, I wished to give my trusty Model I a taste of... high resolution graphics."

When I first saw the TRS-80 Color Computer, I knew that time was short for me and my Model I. Those flashy graphics, those tiny dots, lines and circles, and all that color won me over. But in parting, I wished to give my trusty Model I a taste of those same high-resolution graphics.

This month's project is the result—a grid of graphic dots as fine as those which make up the letters on the screen: 384 across and 192 down. This month's project is also the most complicated and costly you will likely see in my column. I call it "The Detailer." It demands 30 integrated circuits, many hours of wiring, care in assembly, and about \$75 in parts.

After all the work, however, you will have a graphics addition with a resolution higher than any available commercially for the TRS-80, as well as more graphics detail than any other popular home computer. Although no actual grey scale is provided, shades of grey can be simulated by varying the density of the dots used.

Now for the requirements. For greatest ease manipulating the screen, your TRS-80 should have 48K of memory. However, this is not essential. Aside from an edge card connector to attach to The Detailer, you will also have to place two wires directly inside your computer (one to its master clock, and one to its vertical sync line). Finally, the video monitor and the computer's video output will both attach to The Detailer.

Design Thoughts

There were several considerations involved in the design of this board. First, the video signal should relate as closely as possible to that provided by the TRS-80 itself. Next, a relationship should be maintained between the TRS-80 graphics blocks and the higher resolution graphics areas. Finally, both high-resolution drawings and normal text and graphics should be available on the screen simultaneously.

The Detailer is designed so its dot selection and video synchronization are identical to that produced by the TRS-80; this is done simply—by stealing the TRS-80 video circuitry IC by IC. Also, the output signal is of the same amplitude

and timing, thereby providing perfect synchronization between the two units. And, finally, it creates its graphics independently of the text and graphics normally within the TRS-80, meaning both may be mixed on a single monitor, or the TRS-80 and The Detailer may be fed to separate video monitors.

This high-resolution addition consists of several major blocks:

1. A video "countdown" chain almost identical to that inside the TRS-80, which provides row and column addresses for the video dots, and a set of horizontal and vertical synchronization and blanking signals for the video monitor.
2. 12,288 bytes of random access memory to store the high-resolution graphics information. Dynamic RAMs (type 4116—the same as those used for normal TRS-80 memory) are used for this.
3. A latch and shift register to capture the graphics dots and shift them out one at a time to the video screen.
4. Write-select circuits to fill the high-res memory from the TRS-80, and read-select circuits for use by The Detailer. Memory refresh (dynamic RAMs are used) is provided automatically by each screen display cycle.

Immediately upon connecting The Detailer, very fine-definition video graphics are available without complicated synchronization and control-tiddling.

Circuit Details

The timing for The Detailer can be achieved in two ways: first, via a self-contained crystal oscillator made up of Z1, sections a/b/c, two resistors, a variable capacitor, and a crystal. The crystal (10.6445 MHz) is available from Radio Shack as a special order item, for \$4.95.

The second method is easier and more reliable. The clock timing signal is provided by the TRS-80 itself at Z42, pin 6. By running a wire from this integrated circuit inside the computer case to the high-resolution board, accurate and synchronized timing of the video is possible.

The timing pulse is then fed to Z2. This pulse has three results: It toggles the vid-

eo shift register, which sends dots to the screen at a 10 MHz rate; it is divided into a video divider chain signal (0.887 MHz) for the column, line and row selection; and it creates the video byte latch signal (1.774 MHz combined with 3.5481 MHz for a short latching pulse).

Z4 through Z7 represent the video divider chain itself. Sixty-four columns, twelve lines and sixteen rows are addressed by these dividers; the dividers also determine the occurrence of horizontal synchronization (at Z5 pin 11) and vertical synchronization (at Z7 pin 11). The simultaneous occurrence of horizontal and vertical sync determines the blanking period (the time during which the video monitor's electron beam is off), provided by Z9a. For details on the operation of the video countdown chain, read the *TRS-80 Technical Reference Handbook*, which contains an excellent description.

High-res memory is selected in much the same way as that in normal video memory. In this case, when address lines 14 and 15 are high, the high-resolution video is selected. The output of Z15b then swings low, switching multiplexers Z10 through Z13 from the video divider chain to the computer address lines.

Simultaneously, the high-res refresh/select lines (found at the input of Z20) are switched to the computer, completing computer selection of high resolution mode. If the computer's write (WR) line is also low at that time, then the high-resolution memory is written into by the TRS-80.

The video byte selected by the high-resolution board is latched into Z16, and shifted out a bit at a time through Z17. This shifted dot pattern moves through Z15d to Z30, where its voltage level is adjusted to be compatible with normal video output. The horizontal and vertical sync signals, meanwhile, are fed through Z27, Z28, and Z29, and subsequently mixed to provide a composite video output.

This output is then mixed with its synchronous partner, the video output of the TRS-80. The two are synchronized by Z31, which, when power is applied to The Detailer, switches high. The vertical sync signal from Z66 pin 12 on the TRS-80 clears this circuit, allowing the clock pulses to

begin counting through the video divider chain. If for some reason the two boards get out of sync, momentarily depressing S1 will again trigger Z31, restoring synchronization.

Construction Hints

The Detailer is not an easy project to tackle. It requires considerable patience, and you must follow a few important guidelines:

1. Use the power supply as shown. It's crucial that the -5 volt power line be stable first and last, so do not attempt to change the arrangement of parts.
2. Bypass capacitors on all integrated circuits are vital. Use 0.1 microfarad capacitors between +5 volts and ground at each IC, and use good quality glass or tantalum capacitors between +5 and ground, +12 and ground, and -5 and ground on the memory chips.
3. Handle the memory chips with care, and don't put them in their sockets until the circuit is complete. Also, apply power and test the voltages before putting the memory chips in place. Then remove power and insert the chips.
4. Wire-wrap carefully, and keep connections short and clean around the memory and multiplex areas, particularly where the CRAS, CCAS, CMUX, MRAS, MCAS, and MMUX lines are found.
5. Put a heavy heat sink on the 7805 voltage regulator, or use a separate five-volt regulator for the memory chips. Without a heat sink, the power rating of the 7805 can be exceeded and the board will show many memory errors.
6. The board cannot be successfully accessed at high speed. If you have a high speed modification in your computer, make sure it returns to normal speed when writing to the high-res memory.
7. Three hundred nanosecond 4116 dynamic RAMs will give the best results. The memory select circuitry during screen access is very fast, and can outrun some of the old standard 450 nS memories.
8. The line marked "HIRES*" on the schematic is the most time-sensitive, and likely to cause memory drop-outs. Be sure to use the pull-up and pull-down resistors on this line.
9. Occasionally, random dots will turn on in a wire-wrapped version of this circuit. Since a copy of this memory is stored in your TRS-80's RAM, a

Table 1. POKE Codes for High-Resolution Graphics

DOTS	IN BINARY	HEX	OCTAL	DECIMAL
O O O O O O	0 0 0 0 0 0	00	00	0
O O O O O *	0 0 0 0 0 1	01	01	1
O O O O * O	0 0 0 0 1 0	02	02	2
O O O O * *	0 0 0 0 1 1	03	03	3
O O O * O O	0 0 0 1 0 0	04	04	4
O O O * O *	0 0 0 1 0 1	05	05	5
O O O * * O	0 0 0 1 1 0	06	06	6
O O O * * *	0 0 0 1 1 1	07	07	7
O O * O O O	0 0 1 0 0 0	08	10	8
O O * O O *	0 0 1 0 0 1	09	11	9
O O * O * O	0 0 1 0 1 0	0A	12	10
O O * O * *	0 0 1 0 1 1	0B	13	11
O O * * O O	0 0 1 1 0 0	0C	14	12
O O * * O *	0 0 1 1 0 1	0D	15	13
O O * * * O	0 0 1 1 1 0	0E	16	14
O O * * * *	0 0 1 1 1 1	0F	17	15
O * O O O O	0 1 0 0 0 0	10	20	16
O * O O O *	0 1 0 0 0 1	11	21	17
O * O O * O	0 1 0 0 1 0	12	22	18
O * O O * *	0 1 0 0 1 1	13	23	19
O * O * O O	0 1 0 1 0 0	14	24	20
O * O * O *	0 1 0 1 0 1	15	25	21
O * O * * O	0 1 0 1 1 0	16	26	22
O * O * * *	0 1 0 1 1 1	17	27	23
O * * O O O	0 1 1 0 0 0	18	30	24
O * * O O *	0 1 1 0 0 1	19	31	25
O * * O * O	0 1 1 0 1 0	1A	32	26
O * * O * *	0 1 1 0 1 1	1B	33	27
O * * * O O	0 1 1 1 0 0	1C	34	28
O * * * O *	0 1 1 1 0 1	1D	35	29
O * * * * O	0 1 1 1 1 0	1E	36	30
O * * * * *	0 1 1 1 1 1	1F	37	31
* O O O O O	1 0 0 0 0 0	20	40	32

Note: Lighted dots are marked with a star (*); blank "undots" are marked with an o (O).

Table continues

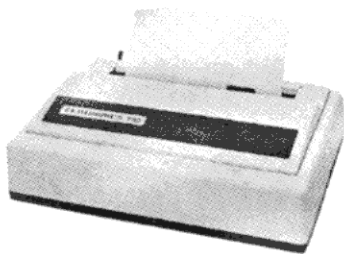
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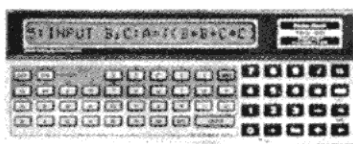
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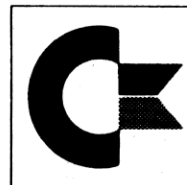


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subroutine to write this copy back into high-resolution RAM can be used:

```

LD HL,0C000H
LOOP LD A,(HL)
LD (HL),A
INC HL
LD A,H
OR L
JR NZ,LOOP
RET

```

How It Works and How to Use It

Look carefully at the dots that make up the letters on your TRS-80 screen. Set a few graphics characters, and turn the contrast and brightness down so the individual dots are clearly defined. You will see that each graphic Set point is really made up of a block of dots, three dots across and four dots down. Now, print a CHR\$(191), and notice that this full block (made up of six of the Set points) is six dots across and twelve dots down.

The Detailer is set up to occupy the top 16K of memory space in the TRS-80. Each byte of high-resolution memory affects six screen dots, in the same way that each byte of normal screen memory affects an area six dots across. The difference is that The Detailer only creates a character one dot deep. That means it takes twelve bytes of memory to create a graphics block six dots across and twelve dots down (like CHR\$(191)).

High-resolution graphics act somewhat like a binary window: Each bit of memory lights up one bit on the screen, like this * * * * *. The right-most bit is bit 0, and the leftmost is bit 5. Bits 6 and 7 are not needed, since each graphics character is only six dots wide. Table 1 shows how a single memory cell would affect the dots on one line of the screen, counting in binary, hexadecimal, octal and decimal.

Chances are you'll never see me use octal numbering in this column again. But it just so happens that these graphics lines are six dots across. Whereas hexadecimal breaks groups of binary digits into fours (0000 0000 0000), octal breaks them up into threes (000 000 000 000), and is mainly a heritage of 12-bit minicomputers. (Note to you machine language programmers—did you know the architecture of the Z-80 is really octal? Check it out.) Octal can be a convenient way of visualizing the six-dot-wide "bytes". If hex or octal doesn't interest you, then decimal will work just fine; cut out or copy Table 1, and refer to the decimal values when drawing lines.

Before drawing lines, it's time to hook up The Detailer. Follow these steps:

- Attach the edge card connector to the TRS-80.

* 0 0 0 0 *	1 0 0 0 0 1	21	41	33
* 0 0 0 * 0	1 0 0 0 1 0	22	42	34
* 0 0 0 * *	1 0 0 0 1 1	23	43	35
* 0 0 * 0 0	1 0 0 1 0 0	24	44	36
* 0 0 * 0 *	1 0 0 1 0 1	25	45	37
* 0 0 * * 0	1 0 0 1 1 0	26	46	38
* 0 0 * * *	1 0 0 1 1 1	27	47	39
* 0 * 0 0 0	1 0 1 0 0 0	28	50	40
* 0 * 0 0 *	1 0 1 0 0 1	29	51	41
* 0 * 0 * 0	1 0 1 0 1 0	2A	52	42
* 0 * 0 * *	1 0 1 0 1 1	2B	53	43
* 0 * * 0 0	1 0 1 1 0 0	2C	54	44
* 0 * * 0 *	1 0 1 1 0 1	2D	55	45
* 0 * * * 0	1 0 1 1 1 0	2E	56	46
* 0 * * * *	1 0 1 1 1 1	2F	57	47
* * 0 0 0 0	1 1 0 0 0 0	30	60	48
* * 0 0 0 *	1 1 0 0 0 1	31	61	49
* * 0 0 * 0	1 1 0 0 1 0	32	62	50
* * 0 0 * *	1 1 0 0 1 1	33	63	51
* * 0 * 0 0	1 1 0 1 0 0	34	64	52
* * 0 * 0 *	1 1 0 1 0 1	35	65	53
* * 0 * * 0	1 1 0 1 1 0	36	66	54
* * 0 * * *	1 1 0 1 1 1	37	67	55
* * * 0 0 0	1 1 1 0 0 0	38	70	56
* * * 0 0 *	1 1 1 0 0 1	39	71	57
* * * 0 * 0	1 1 1 0 1 0	3A	72	58
* * * 0 * *	1 1 1 0 1 1	3B	73	59
* * * * 0 0	1 1 1 1 0 0	3C	74	60
* * * * 0 *	1 1 1 1 0 1	3D	75	61
* * * * * 0	1 1 1 1 1 0	3E	76	62
* * * * * *	1 1 1 1 1 1	3F	77	63

- Attach the video monitor cable to The Detailer.
- Attach a cable from The Detailer to the TRS-80.
- Attach the two wires from inside the TRS-80 to The Detailer, as shown in the schematic.

- Turn on the TRS-80.
- Turn on The Detailer.
- Set the memory size to 49152.

Clearing the Screen and Drawing a Line

The screen will present the memory size query, as usual. If you do not see it, adjust

```

10 CLS : A$ = "12345678901234567890"
20 X = VARPTR(A$) : Y = PEEK(X+1) + 256*PEEK(X+2)
30 Z = Y : FOR N = 1 TO 15 : READ A : POKE X,A : NEXT
40 DATA 175,245,33,0,192,241,119,35
50 DATA 245,124,181,32,248,241,201
60 POKE 16526,PEEK(X+1) : POKE 16527,PEEK(X+2)
70 REM * FOR DISC SYSTEMS USE DEFUSR0=Z
80 M = USR(0) : REM * FOR DISC USE M = USR0(0)

```

Program Listing 1

DOTS	IN BINARY	HEX	OCTAL	DECIMAL
0 0 0 0 0 *	0 0 0 0 0 1	01	01	1
0 0 0 0 * 0	0 0 0 0 1 0	02	02	2
0 0 0 * 0 0	0 0 0 1 0 0	04	04	4
0 0 * 0 0 0	0 0 1 0 0 0	08	10	8
0 * 0 0 0 0	0 1 0 0 0 0	10	20	16
* 0 0 0 0 0	1 0 0 0 0 0	20	40	32

Table 2. Individual Screen Dots

the balance control until it appears. If there is any tearing, twiddle the V-Sync and H-Sync controls until it stabilizes. What you will probably see is a screen filled with garbage dots as well as the memory size question. First, clear the high-resolution screen using Program Listing 1.

Drawing horizontal lines is easy. A solid line is made up of continuous "on" dots, like this: *****/*****/*****/*****/*****/*****. To draw a horizontal line across the top of the screen, we need to know where the high-resolution memory is. It runs from C000 hex (49152 decimal) to FFFF hex (65535 decimal). But wait—Level II doesn't like integers over 32767, so here's the rule: If an integer number X is greater than 32767, then X-65536 is the way Level II needs to see it. So, The Detailer's memory runs (in Level II talk) from -16384 to -1.

That makes the first graphics line 64 places long, from -16384 to -16321. Enter these commands: FOR X = -16384 TO -16321:POKE X,63:NEXT. To understand the command to POKE X with 63, re-

fer to Table 1. Sixty-three is the decimal value to set all dots on. How about a dashed line? Try this: FOR X = -16384 TO -16321:POKE X,56:NEXT. Or, as a final example, a dotted line: FOR X = -16384 TO -16321:POKE X,42:NEXT. By trying different POKE values, the density and character of the horizontal line changes.

Vertical Lines—A Different Story

Vertical lines are a different story, because each vertical dot is 64 memory locations away from the one above and below it. This draws a vertical line from top to bottom in the center of the screen: FOR X = -16352 TO -32 STEP 64:POKE X,1:NEXT. There's a trick to doing single vertical lines. If in this example the POKEd value were 16 instead of 1, the line would move to the left (try it). There are 384 dots across each line of the screen, but only 64 memory locations to hold them—six dots each. Table 2 is an excerpt of Table 1, showing only those POKE values with individual dots, from which thin vertical lines can be built.

Now, I know that's not immediately

comprehensible; it was hardly clear to me when I built it! Remember that horizontal lines were made up of contiguous groups of six bits, each group in a single memory location. Vertical lines don't have any contiguous bits. Every bit belongs to a *different* memory location, 64 memory locations apart. Look at this:

```

0000*0
0000*0
0000*0
0000*0
0000*0
0000*0
0000*0
0000*0

```

There's a vertical line, drawn with a statement something like: FOR X = -16352 TO 0 STEP 64:POKE X,2:NEXT.

Do you see how it carries with it a burden of five other bits representing unlit dots? Now the next question: Let's say we already have a vertical line like the one above. How is a line drawn right next to it? This program won't do it: FOR X = -16352 TO 0 STEP 64:POKE X,4:NEXT, because it will draw a new line in the right place, but POKEing 4 (dots 000*00) will *erase the line already there*. If you know what line is already in place, you can draw it by POKEing X with 5 (dots 000***0), which will create the new line and redraw the second.

There's a better way, but only if you have 48K memory in your TRS-80. Examine these commands: FOR X = -16352 TO 0 STEP 64:POKE X,(4 OR PEEK(X)):NEXT.

What? Time for a quick review of the logical OR function. Logical OR says: Given a pair of items, if either the first or the second is true, the result will be true. In this case, it can be rephrased: Given a pair of graphics bits, if either the first or the second is on, the result will be on. Here is how it looks:

```

Original group of bits (single lines): 0000*0
New group of bits (added line):      000*00
OR function:                          .....
Resulting group of bits (new lines): 000**0

```

To draw another vertical line a few spaces to the left, we would OR the new line with those present in the very same way:

```

Two lines now present:                000**0
New group of bits (added line):      *00000
OR function:                          .....
Resulting group of bits (new lines): *00**0

```

The Disappearing Line

Now how about erasing a line? For horizontal lines, the process is pretty simple...POKE in zeroes, like this: FOR X = -16384 TO -16321:POKE X,0:NEXT. That should make the line on the top of the

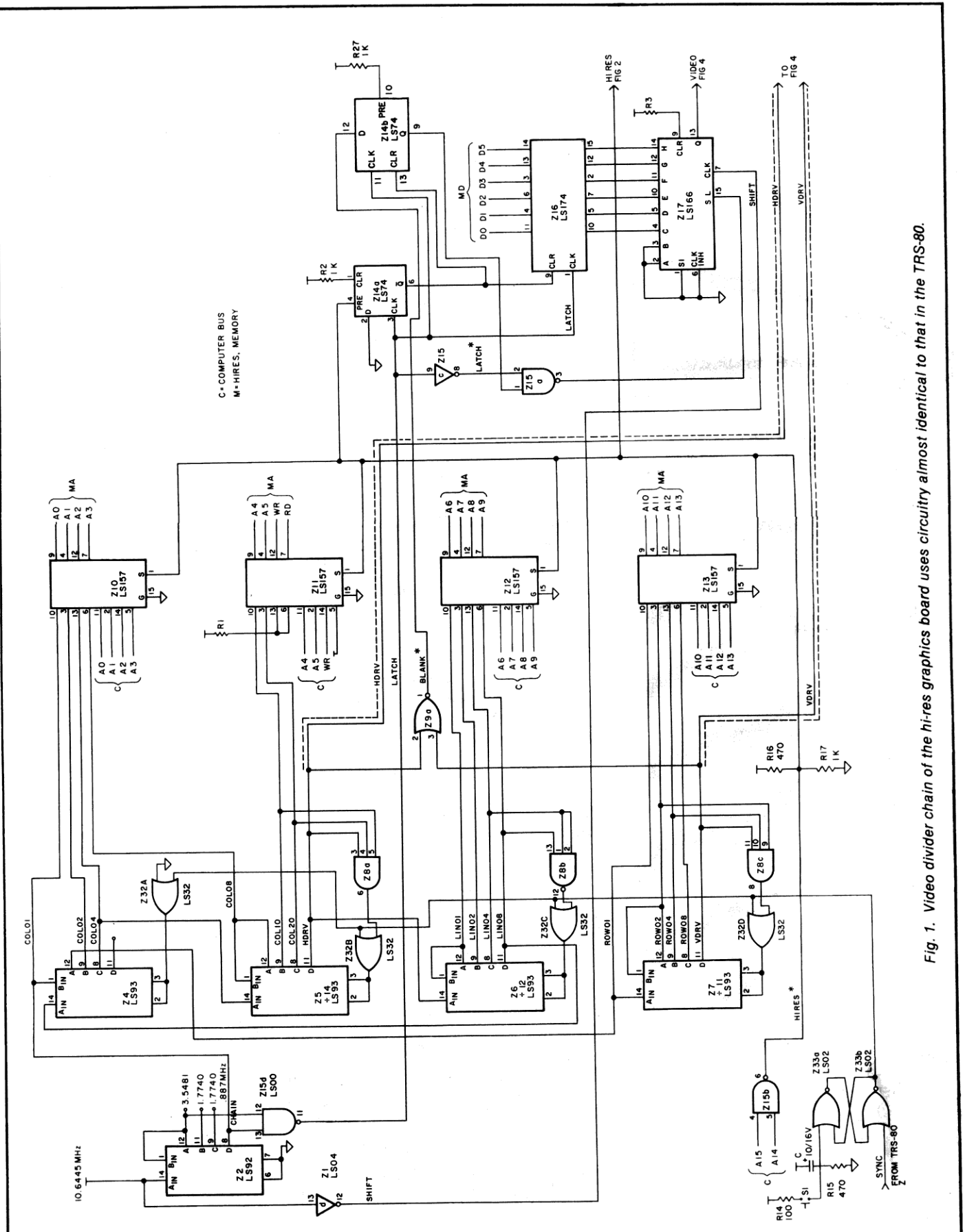


Fig. 1. Video divider chain of the hi-res graphics board uses circuitry almost identical to that in the TRS-80.

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F5	00110	PUSH	AF
21 00 C0	00120	LD	HL,0C000H
F1	00130	LOOP	POP AF
77	00140	LD	(HL),A
23	00150	INC	HL
F5	00160	PUSH	AF
7C	00170	LD	A,H
B5	00180	OR	L
20 F8	00190	JR	NZ,LOOP
F1	00200	POP	AF
C9	00210	RET	

Program Listing 2

Program Listing 3. Drawing Random Horizontal and Vertical Lines


```

10 CLS : REM * SAVE THIS PROGRAM BEFORE RUNNING IT (LINE 30!)
20 REM * HI-RES CLEAR SCREEN ROUTINE FOLLOW IN DUMMY STRING
30 A$="12345678901234567890" : REM * SET UP DUMMY M/L STRING
40 X=VARPTR(A$) : REM * DISCOVER INFO. ABOUT A$ LOCATION
50 Y=PEEK(X+1) + 256*PEEK(X+2) : REM * A$ MEMORY LOCATION
60 Z = Y : REM * SET UP VARIABLE FOR USE IN USR ENTRY POINT
70 FOR N = 1 TO 15 : REM * 15 DATA ELEMENT READ/POKE LOOP
80 READ A : POKE Y,A : Y = Y + 1 : NEXT : REM * POKE M/L INFO
90 DATA 175,245,33,0,192,241,119,35,245,124,181,32,248,241,201
100 DEFUSR0=Z : REM * USE THIS FOR DISK SYSTEM - LII BELOW:
110 REM * POKE 16526,PEEK(X+1) : POKE 16527,PEEK(X+2)
120 M=USR0(0) : REM * USE M=USR(0) FOR LEVEL II SYSTEMS
130 FOR Q = 1 TO 100 : REM * READY TO DRAW 100 RANDOM LINES
140 Z = -16384 : REM * SEE TEXT FOR DESCRIPTION OF THIS VALUE
150 Y = 64 : REM * THIS OFFSET DEFINES VERTICAL POSITIONING
160 A = RND(Y)-1 : REM * CHOOSE ANY OLD HORIZONTAL BYTE
170 AA = (RND(256)-1)*64 : REM * CHOOSE A VERTICAL AREA
180 B = RND(Y)+A : IF B > 63 THEN B = 63 : REM * HOR. GUIDE
190 C = (RND(256)-1)*64 : REM * CHOOSE ANY OLD VERTICAL BYTE
200 CC = RND(63) : REM * CHOOSE A HORIZONTAL POSITION HERE
210 E = RND(255)+D : IF E > 255 THEN E = 255 : REM * V. GUIDE
    
```

Program continues

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```

220 E = E * 64 : REM * DEFINE WHICH VERTICAL LINE TO BE USED
230 F = RND(7) : REM * SELECT A RANDOM VERTICAL BIT POSITION
240 IF F = 3 THEN F = 4 ELSE IF F = 5 THEN F = 8 ELSE
    IF F = 6 THEN F = 16 ELSE IF F = 7 THEN F = 32 :
    REM * CONVERSION OF RND(7) TO A VERTICAL BIT (TABLE 1)
250 REM * ACTUAL DRAWING OF RANDOM LINES BEGINS BELOW:
260 FOR X = A+AA+Z TO B+AA+Z : REM * GET HORIZONTAL POSITION
270 POKE X,63 : REM * 63 = 111111 FOR FULL LINE (SEE TEXT)
280 NEXT : REM * DRAWING HORIZ. LINE IS FASTER THAN VERT.
290 FOR X = C+CC+Z TO E+CC+Z STEP 64 : REM * GET VERTICAL
300 POKE X,(F OR PEEK(X)) : REM * SEE TEXT ABOUT OR FUNCTION
310 NEXT : REM * NO LINES ARE ERASED IN THIS DEMO PROGRAM
320 NEXT Q : REM : COMPLETE DRAWING OF 100 HI-RES LINES
330 GOTO 120 : REM * AND REPEAT HI-RES CLS AND DO IT AGAIN

```

```

10 FOR X = 20480 TO 20505
20 READ A : POKE X,A : NEXT
30 POKE 16526,0 : POKE 16527,0
40 M =USR (0)
50 DATA 175,245,33,0,192,241
60 DATA 119,35,245,124,181,194
70 DATA 5,80,1,0,128,205,96
80 DATA 0,241,60,245,195,2,80

```

Program Listing 4. Vertical Line Drawing Program—BASIC Listing

Program Listing 5. Vertical Line Drawing Program—Assembly Listing

	00090		ORG	5000H
AF	00100		XOR	A
F5	00110		PUSH	AF
21 00 C0	00120		LD	HL,0C000H
F1	00130	LOOP	POP	AF
77	00140		LD	(HL),A
23	00150		INC	HL
F5	00160		PUSH	AF

Program continues

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B5	00180	OR	L
C2 05 50	00190	JP	NZ,5005H
01 00 80	00200	LD	BC,8000H
CD 60 00	00210	CALL	0060H
F1	00220	POP	AF
3C	00230	INC	A
F5	00240	PUSH	AF
C3 02 50	00250	JP	5002H

screen disappear, because all the high-resolution graphics dots on that line are turned off.

But what about the vertical line? Again, it gets just a bit tacky. If we POKE a zero, we will erase any of the six possible vertical lines in that group; here's the status of the three vertical lines drawn above:

```
*00**0
*00**0
*00**0
*00**0
*00**0
*00**0
*00**0
```

... and so on. Another logic function will be called up for this task: logical AND, along with the concept of "masking". First, there's the logical AND function, which states: Given a pair of items, only if both the first item *and* the second item are true, will the result be true. Converted to the high-resolution graphics model, it reads: Given a pair of graphics bits, if both the first *and* the second graphics bit are on, then the result will be on. As an example, the vertical group we currently have is ANDed with a group which is completely turned on:

```
Original group of bits (three lines): *00**0
New group of bits (six lines):      *000000
AND function:                        *00**0
Result of original AND new group:  *00**0
```

Essentially, nothing has changed, because wherever a bit was turned on in the original, it is also turned on in the second group. But here's the problem: Let's say the fourth dot of this group is to be turned off. In other words, *00**0 is to be changed to *000*0.

To solve this, consider how a photographer or painter obtains a properly

balanced and bordered picture or photo. A photographer will place a cardboard frame around a photo to evaluate how it looks, covering up uninteresting or obtrusive areas. A painter will tape over areas which are not to be painted in order to create a sharp border. The first uses a cardboard mask; the second uses masking

Parts List

Z1	74LS04	R2	1K
Z2	74LS92	R3	1K
Z3	74LS74	R4	910 ohms
Z4	74LS93	R5	910 ohms
Z5	74LS93	R6	1.8K
Z6	74LS93	R7	47 ohms
Z7	74LS93	R8	270 ohms
Z8	74LS11	R9	120 ohms
Z9	74LS02	R10	330 ohms
Z10	74LS157	R11	75 ohms
Z11	74LS157	R12	10K
Z12	74LS157	R13	10K
Z13	74LS157	R14	100 ohms
Z14	74LS74	R15	470 ohms
Z15	74LS00	R16	470 ohms
Z16	74LS174	R17	1K
Z17	74LS166	R18	33 ohms
Z18	74LS157	R19	33 ohms
Z19	74LS157	R20	33 ohms
Z20	74LS157	R21	33 ohms
Z21	up4116	R22	33 ohms
Z22	up4116	R23	33 ohms
Z23	up4116	R24	33 ohms
Z24	up4116	R25	33 ohms
Z25	up4116	R26	33 ohms
Z26	up4116	R27	1K
Z27	74C04	C1	47 pf
Z28	74C04	C2	.01 mf
Z29	74C00	C3	10 mf/16v
Z30	75452	C4	330 pf
Z31	74LS00	C5	.046 mf
Z32	74LS32	Q1	2N3904
Z33	74LS02	Q2	2N3904

R1 1K

X1 10.6445 MHz crystal

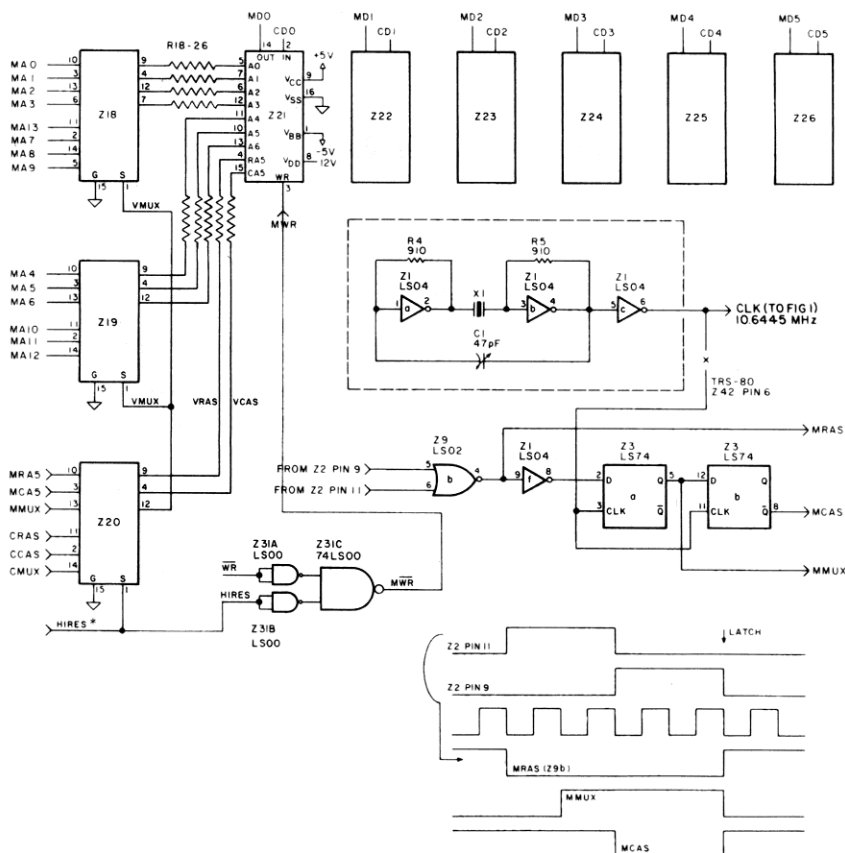


Fig. 2. Memory select-refresh section of the hi-res board. Note that all six memory circuits (Z21 through Z26) are connected in parallel.

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```

C000 (-16384)...Line #1, 64 bytes (384 dots)...(-16321) C03F
C040 (-16320)...Line #2, 64 bytes (384 dots)...(-16257) C07F
C080 (-16256)...Line #3, 64 bytes (384 dots)...(-16193) C0BF
C0C0 (-16192)...Line #4, 64 bytes (384 dots)...(-16129) C0FF
C100 (-16128)...Line #5, 64 bytes (384 dots)...(-16065) C13F
C140 (-16064)...Line #6, 64 bytes (384 dots)...(-16001) C17F
C180 (-16000)...Line #7, 64 bytes (384 dots)...(-15937) C1BF
C1C0 (-15936)...Line #8, 64 bytes (384 dots)...(-15873) C1FF
C200 (-15872)...Line #9, 64 bytes (384 dots)...(-15809) C23F
C240 (-15808)...Line #10, 64 bytes (384 dots)..(-15745) C27F
C280 (-15744)...Line #11, 64 bytes (384 dots)..(-15681) C2BF
C2C0 (-15680)...Line #12, 64 bytes (384 dots)..(-15617) C2FF
- - - - - Unused Memory Area Between Line #12 & 13 - - - - -
C400 (-15360)...Line #13, 64 bytes (384 dots)..(-15297) C43F
. . . . .
. . . . .
. . . . .
C6C0 (-14656)...Line #24, 64 bytes (384 dots)..(-14593) C6FF
- - - - - Unused Memory Area Between Line #24 & 25 - - - - -
C800 (-14336)...Line #25, 64 bytes (384 dots)..(-14273) C83F
. . . . .
CAC0 (-13632)...Line #36, 64 bytes (384 dots)..(-13569) CAFF
- - - - - Unused Memory Area Between Line #36 & 37 - - - - -
- - - - - Blocks of Memory Continue - - - - -
FEC0 (-320)....Line #192, 64 bytes (384 dots)....(-257) FEFF

```

Fig. 3.

tape. The principle is the same with graphics dots.

A mask of "on" dots is placed over the dots we want to keep, and left off the areas we want to turn off. The AND function is used, like this:

```

Original group of dots:  *00**0
Mask of on and off dots: ***0**
AND function:             .....
Result after masking is done: *000*0

```

Using Table 1, you can find that the original group of dots is 38 decimal, and the mask is 59 decimal, and the result is 34 decimal. The BASIC line to accomplish this example would be: FOR X = -16352 TO 0 STEP 64: POKE X, (59 AND PEEK(X)): NEXT.

With all this in mind, try Program Listing 3, which is a complete program to draw 100 random horizontal and vertical lines using The Detailer.

As a final example, Program Listings 4 and 5 create a stream of vertical lines, drawn using values from 0 to 63, and repeating. You will see fine lines, simulated white and grey areas, and broad bands of the kind you could create with Set/Reset graphics. (Note: You must press Reset to exit from this program).

Monkeys in the Works

Back a few dozen paragraphs, you might recall a mention of 12 horizontal lines per group, for a total of 12,288 bytes. With some fast sleight-of-word, I hoped none of you would have done any quick calculations ahead of time. Because I chose to duplicate Radio Shack's video addressing scheme, the graphics units are six bits across. The two remaining bits are ignored, and don't appear in the circuitry—only six 4116's are used.

However (I begin to sweat here), the 4116 memories are 16K memories, meaning there are 16,384 bits available. Only 12,288 are used. Where are the rest? Well...uh...they're...how do I say this...invisible. They are the unaddressed locations between the twelfth line and the sixteenth line.

Instead of one of my hopelessly confusing verbal explanations, look instead at Fig. 3. You'll see that locations -16384 to -16321 (hex C000 to C03F) are line number 1; -16320 to -16257 (hex C040 to C07F) are line number 2; and continuously down to -15617 (C2FF hex), which is line number 12. At that point, four lines are unaddressed, which means that -15616 to -15361 (C300 to C3FF hex) are unused memory locations. POKE something between -15616 and -15361 and nothing appears on the screen. Oh, yes, it does go

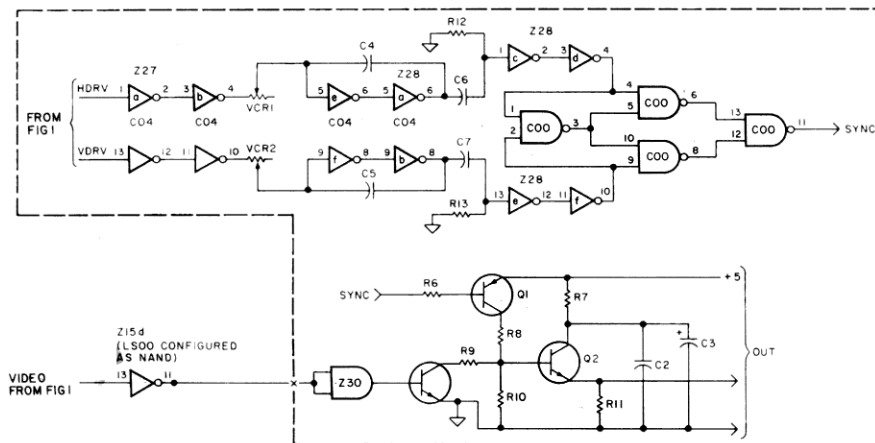


Fig. 4. Horizontal and vertical synchronization circuits and video output circuit. Like the video divider chain, these circuits are almost identical to those used by the TRS-80.

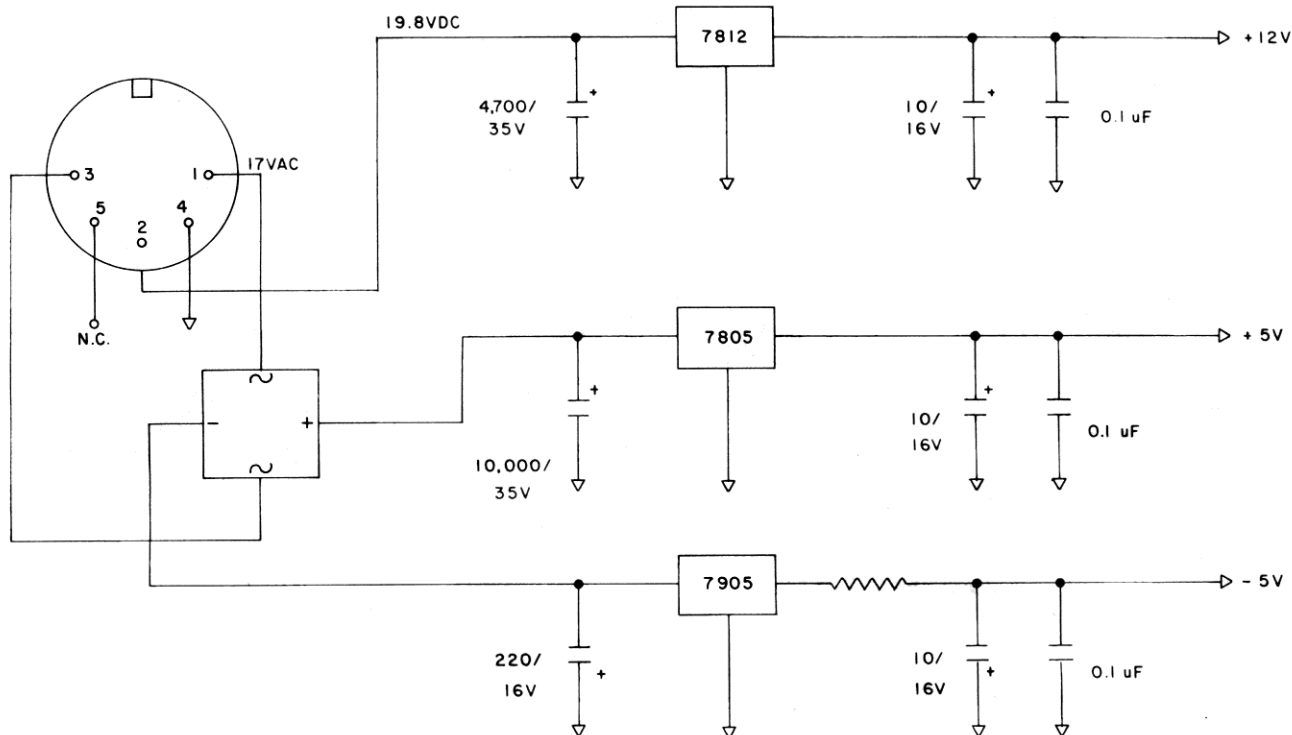


Fig. 5. Power supply for the hi-res board has +12, +5 and -5 volt-outputs. This design is critical—see text.

into memory, but that memory isn't displayed (oh, no!).

As long as you're drawing horizontal and vertical lines, the invisible memory can be ignored. Just remember to consider the length of vertical memory when trying to draw such things as truly square boxes. When doing three-dimensional simulations, circles or ellipses, and other drawings where proportion and scale are important, you must take the unused memory blocks into consideration.

High-resolution memory of the kind available from The Detailer can be a plea-

sure; animations won't come alive as fast, but the clarity and shading made possible can add a new dimension to your home computer use. I would be happy to publish any fast machine language programs created for this board.

Updates

Have you tried to pick up one of the new lowercase chips from Radio Shack? The ones which sold for \$12.93? Well, forget it for awhile. The latest price I paid (in May) was \$37.50. Anyone for letters to Tandy's president about this curiously steep price increase?

Model III users, please note: Most of the machine language software you see in *80 Microcomputing* that uses cassette input/output will not work unmodified. You can try writing to the authors, but don't expect miracles. Many authors like myself have opted for the Color Computer instead of the Mod III.

A printed circuit board is now available for the Micro Front Panel (May "Applications"); write to me at Roxbury, Vermont 05669 for information. Note that Radio Shack no longer stocks the 74LS373 parts, but they can be obtained from other major suppliers. ■

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"Potential problems from non-ionizing microwave radiation have created the most controversy. . . ."

Workers, Unions Concerned Over Video Display Health Issues

Increasing concern among office workers in the U.S. and Canada over the possible harmful effects of video display terminals is growing, as evidenced by several union actions this past spring.

In Toronto, the Communications Workers of Canada (CWC) convinced Bell of Canada that pregnant workers should be allowed to move the non-VDT tasks or take early leaves of absence. The decision followed a work boycott by four pregnant workers who feared that radiation from the terminals could harm their unborn children.

"Many (micros) do not offer detachable keyboards; the screens generally are not adjustable; the nonglare features . . . inadequate. . . ."

In San Francisco, employees at Blue Shield of California ended a 19-week strike that was called partly over what the Office and Professional Employees Union (OPEU) felt were poor working conditions at VDT stations. Concessions by Blue Shield included foot rests, better lighting, nonglare shields for terminals and adjustable chairs.

Potential problems from non-ionizing microwave radiation have created the most controversy, despite tests by the National Institute for Occupational Safety and Health (NIOSH) and the Food and Drug Administration's Bureau of Radiological Health that showed radiation lev-

els below the U.S. standard of 10 milliwatts per square centimeter (10 mW/cm²). The CWC action came closely on the heels of a situation at the *Toronto Star* in which four women working on VDTs gave birth to children with birth defects. Further, the Newspaper Guild, which represents 32,000 newspaper employees in the U.S. and Canada, has seen at least a dozen members develop cataracts, which some doctors feel were caused by the non-ionizing radiation.

"The *Toronto Star* situation remains unexplained," says CWC Health and Safety Officer Gary Cwitco. "While many officials and any number of scientists have said that the terminals were not responsible, they can't tell us what was."

While questions surrounding radiation from VDTs will probably not be answered for years, studies point to a number of other pressing problems. Poorly designed equipment and ill-conceived work places have prompted VDT operators to lodge a variety of health complaints with employers and unions.

At Blue Shield of California, for example, NIOSH found that 90 percent of a group it sampled had experienced back problems during the previous 12 months. Operators also reported tearing or itching of the eyes (79 percent), headaches (89 percent), severe fatigue or exhaustion (83 percent), blurred vision (78 percent), and eyestrain or sore eyes (93 percent).

NIOSH and other researchers say that such problems are caused by poor lighting, heavy glare, improperly adjusted chairs and tables, nondetachable keyboards and poor terminal displays. Both manufacturers and employers must assume partial responsibility—the manufacturers because they've tended to emphasize cosmetics over user comfort, and employers because they've rushed headlong into office automation without con-

sidering the impact on workers.

"Some employers have been responsive," says OPEU Research Director Gwen Wells. "But when they put a machine in the office, they put them there to increase production, and that's what they're concerned about. So you can talk about rest breaks, but they want their machines to be running full-time. Some of these changes cost money."

For the moment, microcomputerists have remained relatively unaffected by the controversy. Says Steven Sauter, a psychologist with the University of Wisconsin

"Poorly designed equipment and . . . work places have prompted VDT operators to lodge a variety of health complaints. . . ."

Department of Preventive Medicine:

"The types of users you're talking about are generally highly motivated, high-level, well-trained individuals. The work they're doing is more creative. So I think that the problems we're seeing right now in the office will not exist in the home."

"In the office you're talking about a fast pace, routine work, no control at all in the work place, no dedication to or personal interest in or understanding of what they're doing. At home, you can live with the inconvenience for short periods of time."

But as microcomputers are used more in businesses and schools, problems are

sure to arise. Says Sauter of equipment for the home, "that stuff is still in the Neanderthal Age." Many do not offer detachable keyboards; the screens generally are not adjustable; the nonglare features are often inadequate; the quality of the terminal display—especially when a TV set is used—can cause a great deal of eyestrain.

While consumer demand has com-

pelled many mainframe and minicomputer manufacturers to pay attention to human engineering, microcomputer firms have faced little pressure. In fact, some see little or no problem at all.

"It used to be a big problem that there was no software," says a Tandy engineer. "Now we've got software for the machines, and people start nit-picking. The major points are solved, and they're look-

ing for the minor points."

NIOSH researcher Dr. Marvin Dainoff takes a different approach. "People are so excited about these, and so impressed by their capabilities, that they'll overlook the problems," he says. "But I would guess that home users sooner or later will want better design."

by Eric Maloney
Kilobaud Microcomputing

American Comes Home from Asia To Head Tandy's Manufacturing

Seymour Bogitch, a top manufacturing executive from Tandy's Asian subsidiary, has been promoted to the new position of Senior Vice President for Electronics Manufacturing for Tandy/Radio Shack, Fort Worth, TX. He will be responsible for Tandy's 26 manufacturing facilities in the U.S., Canada and Asia, and Tandy's two product development engineering groups in the U.S. and Asia. He will report directly to Tandy President John V. Roach.

Bogitch said his new position is a combination of two existing posts.

"We have plants in the U.S. and Canada and in the Orient," he said. "In the past we had a vice president for North America in manufacturing and the equivalent in the Orient. No one was officially on top of both. John Roach used to do that."

The new position, therefore, was a result of Roach's promotion. Bogitch was a natural choice for the job. An electrical engineer with a master's degree from Northeastern University, Boston, MA, he has been representative-director for manufacturing for Tandy Electronics—Asia, Tandy's Japanese-based Far Eastern subsidiary, for 10 years. Before that he installed radio stations. He worked directly under the Japanese president of the subsidiary and was responsible for Tandy plants in Japan, Korea and Taiwan.

Bogitch said they make a variety of things in the 1,500-employee Korean and the new 1,000-employee Taiwanese facilities. They make Tandy's CB equipment, many small radios such as the Weather Radios, almost all Tandy's hi-fi equipment, public address systems and multi-meters. The Japanese plant, originally a manufacturing factory, has been turned into a research and development and pur-

chasing installation, he said. The staff, once close to 200, has shrunk to 25 in response to changing economic conditions. Bogitch said it just isn't economical to make these things in Japan because of rising wages.

Although born in New York, Bogitch has lived on and off in Japan, "since I became a big boy." He was living in Japan when Tandy hired him. He is married to a Japanese woman, and they have two children. He said the boy, Ray, 4, understands English but prefers to speak Japanese. The girl, Yoko, 8, is completely bilingual. They have lived in Hiroshima, Nagoya and Tokyo. They now live in Fort Worth. He said they are all adapting quickly, although Japan still "feels like home" to him.

Bogitch is a job-oriented man who spends his personal time reading and watching television. He said he gets the greatest on-the-job satisfaction from being involved with new products.

"I'm proud I contributed to the new things we made in the Orient," he said. "When we came out with our digital receivers, for instance, we had one of the lowest-priced on the market. With telephone equipment we started from almost nothing and became one of the world's largest suppliers. It was the same with CBs. We are one of the largest suppliers of multimeters."

He said he hopes to continue to expand Tandy's manufacturing capabilities and add new items like the TRS-80 microcomputers. Tandy manufactures all of these except the Pocket Computer, which they buy from Sharp.

"I'd like to come up with a few others like those," Bogitch said.

In fact, Tandy's biggest computer manu-



Seymour Bogitch

facturing problem is keeping up with demand. Bogitch said they have not caught up yet, but he hopes to solve that problem in the next few months.

In that vein, he said the new Texas Peripherals plant Tandy established last year in conjunction with Datapoint Corp. is going well. Under that unusual arrangement, each firm owns half the facility. So far its only product is a Radio Shack disk drive, but he said it will be making products for Datapoint soon as well.

"We are technically oriented," Bogitch said. "We are generally considered mostly a retail operation, but we do have a considerable manufacturing capability."

by Bert Latamore
80 Microcomputing Staff

Dutch to Air BASIC Program

In what may be a first, an international shortwave broadcasting station will soon broadcast a machine readable computer program around the world.

On Sept. 10, the Dutch World Radio Service, Hilversum, Holland, intends to broadcast a brief BASIC program in computer ready, CLOADable form as part of a weekly science segment called "Media Network". The show features microcomputers as its topic, and the BASIC program broadcast will be a housekeeping program. It will be broadcast in TRS-80, Apple and Pet compatible formats.

The broadcast may herald a new era in information exchange for microcomputerists. Should the reception of computer programs over the shortwave bands by listeners equipped with ordinary receivers turn out to be a straightforward process, the dissemination of software for popular microcomputers could take a large leap forward: A leap made at the expense of the many cable network facilities now being planned. In addition, the public broadcast of machine readable code could pose new legal questions for the precedent-poor microcomputer software industry.

The key to the success of the experiment lies in the Dutch station's signal strength in the targeted reception area. If the received signals are strong, free from fading and phase distortion, and atmospheric noise levels are low, listeners around the world stand a good chance of successfully recording the computer program.

According to Johnathan Marks, the producer of the Media Network show, similar experiments have successfully been performed within Holland by the Dutch domestic broadcasting service. A weekly program called "Hobbyscope" has used FM transmissions to broadcast several BASIC programs to its listeners.

This experiment on the international shortwave band will be conducted in the AM transmission mode, however. The resultant loss of fidelity and increased susceptibility to noise inherent in AM transmissions may cause problems for listeners in weak signal regions of the world. With this in mind, the Dutch Broadcasting Service will use its remote transmitting facilities in Bonaire in the Caribbean and in Madagascar to ensure adequate signal levels in North America and throughout the world.

It is the Dutch Broadcasting Service's hope that computerists around the world tune in to the Media network segment at the proper time and frequency (see Table 1) and make an effort to record the BASIC program. Listeners are encouraged to report their results to Radio Netherlands as soon as possible at the following address: Computer Experiment, Media Network, Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, Holland. If the transmission is a success, additional shortwave computer program transmissions are planned.

Several measures can improve your chances to successfully receive the computer program. First, use a good quality, highly selective shortwave receiver. Since adjacent channel interference in the form of heterodyne tones and cross-talk is

common in the crowded international broadcast bands, a receiver that minimizes the amount of this interference is desirable. Also, a good quality antenna that maximizes received signal strength is a must. While a directional dipole antenna cut for the specific frequency of the transmission is ideal, a 50 to 100-foot length of wire is satisfactory. Finally, the received audio signal should be routed directly from the external speaker jack of the receiver to the input jack of the recorder.

By following a few precautions, and if atmospheric conditions are right, the Sept. 10th experiment may have far-reaching implications in the computing world. Tune in.

by Chris Brown
80 Microcomputing Staff

TARGET RECEPTION AREA	FREQUENCY (KHz)	TIME (GMT) +
Eastern N. America	9590 & 6165 KHz	02:47*
Western N. America	9715 & 6165 KHz	05:47*
Australia	9770 & 9715 KHz	07:47
Australia	9715 KHz	08:47
Europe	15560, 11930, 9895, 6045 & 5955 KHz	09:47
Europe	17605, 11930, 9895, 6045 & 5955 KHz	13:50
S. E. Asia	11735, 15560, 21480 KHz	14:47
East Africa	15220 & 6020 KHz	18:47
West Africa	21685, 17695, 17605, 15220 & 9715 KHz	20:47

+ Note: Greenwich Mean Time is five hours ahead of Eastern Standard Time.

* Times indicated are early Friday morning GMT. Note that it is still Thursday evening in target area.

Table 1. Radio Netherlands Transmission Specifics for Media Network Program Segment

Retired Tandy/Radio Shack President Granted Honorary Boston U. Doctorate

Retired Tandy/Radio Shack President Lewis Kornfeld has received an honorary Doctor of Humane Letters (LHD) degree from Boston University, Boston, MA.

BU said Kornfeld, who is vice chairman of the Fort Worth, TX, based Tandy Corporation, played an "exceptional role in the development of a great corporation that has had a profound influence on Ameri-

can life."

Kornfeld joined the original Boston Radio Shack store in 1948 as advertising manager. In 1954, by which time the store's business had tripled to \$3 million a year and the staff grown from 30 to 60 people, he was named vice president of advertising. In 1958, with Radio Shack sales at \$6 million, he became vice president of merchandising and advertising.

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TRS-80 is a registered trademark of the Tandy Corp.

Kornfeld stayed with the firm when it was bought out by Tandy Corp. in 1963 and later said his decision to do this was a turning point in his life.

Kornfeld is considered by the company to be the "father of manufacturing at Radio Shack."

He said bringing Tandy into the manufacturing end of the electronics business when he did was a significant development.

"There wouldn't be any TRS-80 computer if we hadn't... had seven or eight years of manufacturing experience."



Lewis Kornfeld

"There wouldn't be any TRS-80 computer if we hadn't already had seven or eight years of manufacturing experience under our belts," he said.

Kornfeld also received the Distinguished Professional Achievement Award from the University of Denver earlier this year.

by Bert Latamore
80 Microcomputing Staff

Radio Shack April Sales Jump 31 Percent over '80

Tandy/Radio Shack, Fort Worth, TX, had 31 percent higher sales this April than it did a year ago, and Garland P. Asher, director of financial planning for Tandy, sees it as a sign that the retail market is firming up. Asher said April was the third straight month of unexpectedly high sales figures. He said this may be a reflection of the unexpected strong upturn of the U.S. economy in the first quarter of 1981.

On the other hand, he said, Tandy's ups and downs are generally not tied as much to economic figures as they are to technological trends. For instance, 1974 was a recession year, but it was a good year for Tandy, which was riding the CB boom. In 1977 positions were reversed. Tandy, tied to a CB market bust, performed sluggishly, while the economy generally was strong.

Asher said whatever is fueling the present increase, it seems to involve a broad cross section of Tandy products. He said he didn't have any inventory breakdowns for April, but the indications were that while computer and telephone products

were among the leaders for Tandy, other Radio Shack products were also attracting larger markets. Tandy's stereo equipment, which has suffered from depressed sales for more than a year, for instance, has picked up considerably, he said.

One interesting part of this phenomenon, he said, is that the Great Lakes industrial cities including Detroit and Pittsburgh, which have been depressed market areas for some time, are showing 20 percent sales gains over a year ago. He said he had no idea why this is happening.

The figures as released by Tandy showed a consolidated sales totaling \$138,048,000 for April, a 31 percent increase over the \$105,179,000 figure of a year ago. These figures include both sales in the U.S. and overseas. The U.S. figures were \$111,562,000 for April, up 32 percent from \$84,238,000 for a year ago. Sales in U.S. Radio Shack stores in existence more than one year rose 20 percent in April over a year ago.

by Bert Latamore
80 Microcomputing Staff

Personal Micro to Fight Shack Suit, PM Prexy Terms It Scare Tactic

Personal Micro Computers, Inc. (PMC), Mt. View, CA, has issued a statement promising vigorous defense in a suit filed by Tandy/Radio Shack, Fort Worth, TX,

tential dealers who might be interested in carrying the PMC-80 product line."

At issue is the PMC-80, a Z-80 chip-based microcomputer compatible with

"It is quite obvious that the purpose of this suit is to intimidate... PMC dealers and... 'scare off' potential dealers..."

charging copyright infringements.

Dr. Lester Lee, PMC president, said, "It is quite obvious that the purpose of this suit is to intimidate present PMC dealers and, most importantly, to 'scare off' po-

most TRS-80 software and peripherals. Tandy, in the suit filed Feb. 19 in U.S. District Court, San Francisco, CA, claims the machine's I/O routines are copies of TRS-80 routines and violate Tandy

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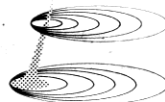
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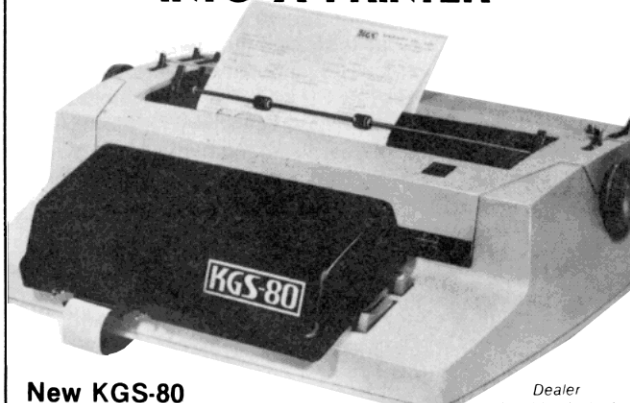
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80 NEWS

copyrights. They also maintain the PMC-80 trademark is "confusingly close" to the TRS-80 name and is a trademark infringement. Named in the suit with Personal Micro Computers is EACA, the Hong Kong-based manufacturer of the microcomputer, and several U.S. distributors.

Lee said PMC-80 "will give... independent software and hardware suppliers an alternative vendor to proliferate their product in the true spirit of free enterprise."

As evidence that the suit is aimed basically at discouraging potential dealers, Dr. Lee cited "the fact that Tandy did not inform PMC or EACA about any possible infringement by the product prior to filing the suit."

Lee said Tandy is trying to eliminate competition.

"While PMC-80 has been delivered for only about six months here in the United States, the same product has been widely accepted in Europe and other countries as the Video Genie marketed by distributors for EACA," Lee said. "In many countries the Video Genie has been out-selling the TRS-80, and this has probably prompted Tandy to take action in an attempt to quench PMC before it gets a strong foothold in this country."

Atty. Gary Pat, a Tandy spokesman on legal matters, said Tandy's policy is to refuse to comment on the case outside court.

by Bert Latamore
80 Microcomputing Staff

Computer Literacy Made Requirement for Graduation

Nolan Catholic High School in Fort Worth, TX, has established a unique requirement for graduation. Along with the more traditional areas of academic competence, students will soon be expected to demonstrate computer literacy.

Although computer literacy will not be mandatory until the 1982-83 school year, courses in BASIC programming began in August 1980. Currently in use are one Level II and 17 Level I's which were donated to the school. Another Level II will be

courses offered by the school, according to Brother Tony Pistone, principal at Nolan Catholic. This year more than 60 parents attended an introductory computer class held at the school at night.

A major source of difficulty has been the lack of high quality, commercially prepared educational software, according to Brother Pistone. Two professional programmers have been hired for the 1981-82 school year to fill the gap created by the lack of good software and help teachers

"Two professional programmers have been hired... to fill the gap created by the lack of good software...."

donated for use in September, 1981.

This year, approximately 150 students have taken the courses which emphasize a hands-on approach to programming. Over 200 students are expected to sign up for next year's offerings which, in addition to beginning level courses in BASIC, will also include word processing and data processing for more advanced pupils.

Parents as well as students have responded positively to the computer

learn new ways to utilize the micros in their courses.

Brother Pistone is enthusiastic about the current computer literacy program at Nolan Catholic and the school plans to expand the program in the coming years. According to Pistone, computer literacy is now "as critically important in learning as reading, writing and arithmetic."

by Lise Markus
80 Microcomputing Staff

80 CALENDAR

July

July 5-31 The Hill School, Pottstown, PA, will conduct **four one-week computer workshops** using the school's PDP 11/34 system and will offer students maximum hands-on experience. The first three workshops will be open to students of Grades 7-12. The last will be for teachers and other professionals.

Contact John E. Parnell, The Hill School, Pottstown, PA 19464, for information.

July 13-14 will see a **seminar on using the OASIS operation systems on Z-80 microcomputers** at Phase One Systems, Oakland, CA.

Classes will be limited to 20-30 students with plenty of "hands-on" activities. Price is \$195. Information is available from Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA, 415-562-8085.

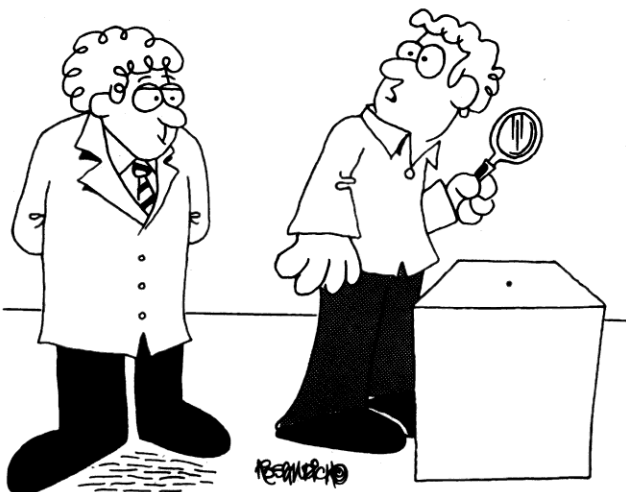
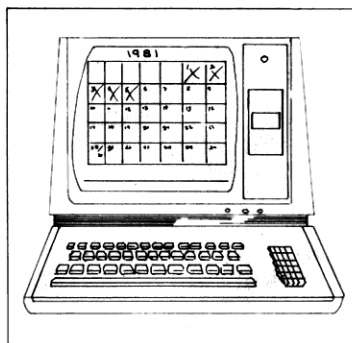
Motorola Technical Training Headquarters is offering seminars on their 6809 microprocessor chip July 21-24 in Phoenix, AZ; July 7-8 in Los Angeles, CA; and July 9-10 in San Diego, CA. They will cover all aspects of chip operation including software design. Seminar cost varies from between \$300 and \$450. Information is available from Ron Bishop, Motorola Technical Train-

ing Headquarters, TOM-57, PO Box 2953, Phoenix, AZ 85062.

August

Aug. 28-29 the **International Microcomputer Fine Arts Festival** will combine artists using or interested in using microcomputers with programmers and other technical people who have done work applicable to the needs of artists at the Teela-Wooket Camp, Roxbury, VT.

The event is sponsored by Trans/Media Inc., a non-profit artists' cooperative; Green Mountain Micro; Wayne Green, Inc.; and individual artists and programmers. Information is available from Dennis B. Kitz, festival director; and Richard B. Fredette, festival coordinator, both of Roxbury, VT 05669 (802) 485-6112.



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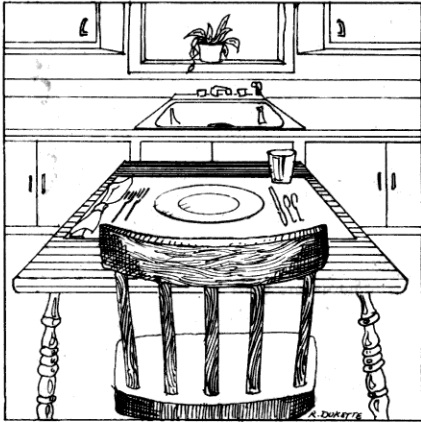
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News From KITCHEN TABLE SOFTWARE, INC.

*Ultimate DOS: Still
not available from
Kitchen Table Software*



Last night, I dreamt that I was sent a review copy of the ultimate disk operating system for the TRS-80 Model I. Unfortunately, I woke up before I was able to produce a backup disk of this wonder product, called DROSSDOS 1.1. Even though no copies are known to exist in the real world, I thought I'd go ahead and write the review, anyway.

DROSSDOS 1.1 from the Kitchen Table Software Corporation contains many useful utility programs. It might be helpful to explore some of their features before delving into the actual operating system and Disk BASIC enhancements.

Superduperzap

Superduperzap is a great multi-purpose machine language disk utility program, which works in conjunction with a small hardware modification recommended by Kitchen Table Software.

When used in a compatible computer, Superduperzap will read or write to any disk sector, or main memory, including the ROM! To write to the latter, the user must make a few changes to the keyboard, which include replacing the Radio Shack ROM with an EPROM supplied by Kitchen Table, adding a small ultraviolet lamp and several printed circuit cards. The entire installation was completed by the author in only 17 hours.

The work was well worth it. Superduperzap repairs Parity Error During Write, Di-

rectory Error During Write, disk-destroying blunders and performs proper repairs to sectors. No user input is required. To invoke, the abbreviation FT is entered or (optionally) the full command Fix That! may be used.

This program will automatically recover accidentally killed disk files. The syntax for this function is as follows: Resurrect filename/ext, :? Superduperzap will search through all available sectors on all disk drives until the remains of a file by that name (or anything similar) are found. The file will be restored and the directory updated. If some of the sectors have already been overwritten, Superduperzap will invent machine or BASIC code that looks good and fits in with the rest of the program. This reconstruction may be entirely transparent to the end user.

Superduperzap has too many capabilities to discuss here. For example, the program can be commanded to ignore read and write protected sectors entirely, forever, and will list the contents of a given track to a printer, the CRT screen, your color television set, or the face of any LCD display digital watch within three feet of the keyboard.

Editor/Disassembler is another machine language program. When used with any optical character reader, it will capture assembly language programs printed in microcomputer magazines, and assemble them into flawless command files. It also will take Z-80 object code and disassemble it, providing helpful remarks which explain the purpose of each instruction. If the program, as entered, conflicts with other machine language programs that will be loaded simultaneously, this module will re-write the code to relocate to other addresses.

The user may also input code, which is automatically debugged. I liked this editor's flexibility; I didn't have to be excessively precise when entering instructions. If I was close, Editor/Disassembler would make a good guess as to what I meant and supply the correct op code.

Programmers with a Sense of Humor

Lodecodeoffset is another program

which was also written in machine language. (You've really got to hand it to the Kitchen Table boys for entirely eliminating the utilities originally supplied with DROSSDOS 1.0, which were written in Pilot.)

Lodecodeoffset takes any machine language program, and, if it conflicts with DOS, some other binary module, ROM, or your automatic phone dialer, relocates it into unused memory. The Kitchen Table wizards have found an extra few hundred bytes of memory that is included in the 64K that can be addressed by the Z-80, but which are not included in the 12K ROM, video memory, or user RAM. Eight IC memory chips are supplied with DROSSDOS 1.1, and can be installed by the user in a few weekends.

Warning!! Each time Lodecodeoffset is run, the program adds an appendage to the code. This appendage has no purpose, except that when appendages equal to 255 bytes have been added, the object code is automatically destroyed beyond recall, even with Superduperzap. My sources tell me that this feature is a joke dreamed up by the Kitchen Table staff late one Friday night. It's always refreshing to see programmers with a sense of humor.

Adventure Disassembler is a 36K program written in BASIC, with no purpose other than to solve Adventures. It will take any adventure written by Scott Adams, and, through sophisticated byte crunching, provide a printout of the location of all treasures, secret words, and proper use of each object. We tried it on a couple of our own adventures and discovered that by stuffing the Mongoose/Squirrel into the tape recorder, and throwing it through the window of the Mystery Fun House, you can gain access to the dumb waiter!

Dirfink is a program that will test a target disk's directory and, if any errors are found, provide the name of the operator who was running the TRS-80 when the problem occurred. When the messages Bad Gat Sector Byte and Extent Space Overflows Diskette are displayed, Dirfink explains what these mean, and automatically invokes Superduperzap to correct the problem. Another handy program.

TI59/CMD is a program that allows the TRS-80 to emulate a TI-59, with the added capability of storing the programs to disk. I tested this module carefully, and found that it worked. Using it, I was able to combine all the power of a TI-59 program-mable calculator with the portability of a 48K TRS-80 with four disk drives in one machine. Somebody should have thought of this one a long time ago.

Middlecase/DVR allows users who have neither upper nor lowercase character generators in their machines to make use of the less popular middlecase character set. A specialized program, to be sure, but with 300,000 copies of the TRS-80 Model I sold before Radio Shack decided to discontinue it, you're bound to find several hundred of almost any wild configuration you can think of. I personally have seen several TRS-80s whose owners have installed inverted keyboards.

DOS Library Commands in DROSSDOS 1.1

Some unusual library commands in this DOS include Checkout, Overdue, Cannot Renew and Reference Only.

The more usual commands such as Chain, Clock, Kill, List, Load, etc., are also included. One caution: Just because you have read the TRSDOS manual, do not assume that you know everything there is to know about DROSSDOS commands. There are some subtle differences. For example, in DROSSDOS, Kill causes the computer to energize the keyboard with 110 volts. The correct DOS command to get rid of a file is Erase. Even here, Kitchen Table has built in some valuable error checking. Below is a sample computer-human interchange:

```
Erase TestFile/BAS:1
Do you really mean that?
Yes
O.K. Enter the password.
No
Then say "please."
```

As you can see, it is nearly impossible to kill a file by mistake, or even on purpose. DROSSDOS has certain other "friendly" characteristics. For example, the following input might be used: BASIC 64000 RUN "STARWARS/BAS". The computer responds: "Excuse me. I found BASIC, but do you really want me to keep 64,000 buffers open for I/O files? Or should I have looked for a program called BASIC 64,000? Should I load STARWARS/BAS before I run it, or what?"

Some DOS commands can be run without any user input whatsoever. Dump will cause the computer to spill paper from

any attached printer onto the floor. Purge commands the system to build a blacklist from any mailing lists on its disks. DIR compiles a list of all programs on a disk, but it won't tell you what they are.

Other handy DOS commands: Verify asks the operator's name twice and then checks both answers to see if they are the same. MDcopy produces duplicates of patient invoices for physician's accounts receivable programs. Rename allows the operator to enter different names when asked by Verify.

Sysgen is a very powerful command that deserves an article of its own. Using a complicated series of switches (numbered SW1 through SW255), the user can configure the operating system to suit specialized needs. A few of the many options are explained below.

SW14 = n, where n is a number between one and four. This allows the operator to specify which disk drive is prone to failure, and the system will automatically avoid using this drive whenever possible. Also, whenever a Parity Error During Read or Data Record Not Found During Read error is caused by this drive, the system will ignore data supplied by the suspect drive, and use something interesting from the same sector on some other drive.

SW18 = Y or N. This switch is used to flag the marital status of the primary operator of the computer. Thereafter, all programs using gender and titles will address the operator as Mr., Mrs., Miss or Ms, as preferred.

SW20 = n, where n is a number between 0 and 255. The computer will always use this number as a seed for generating pseudo-random numbers, thus ensuring predictability when the operator wishes to win dice, cards and other computer games.

SW103 = message string. The message can be any cute saying the operator wishes to display whenever the system crashes. It also relieves boredom, and can be changed as frequently as necessary.

Most features of Disk BASIC remain the same under DROSSDOS 1.1. Several new capabilities have been added. Program lines can be renumbered using a simple Renum command. If no values are specified, the program will be renumbered beginning with line 0, to the end, in increments of 10, but in reverse order. That is, a renumbered program might begin at line 10000, and end at line 10.

Renum R directs the system to renumber the lines in random order. However, because all GOTO's and GOSUB's are changed to the correct new line number, the program will still work. The BASIC in-

terpreter has been altered so that it is not confused to find line 69 following line 186½.

Renum P renumbers a program using only prime numbers as line numbers, while Renum F employs, you guessed it, only Fibonacci numbers for renumbering. Hats off to the Kitchen Table gang for another stroke of originality.

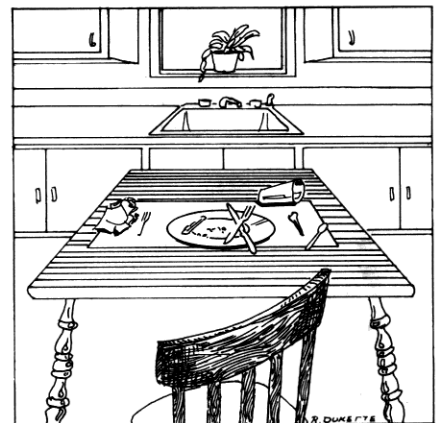
The popular Ref command has been expanded greatly. Under DROSSDOS 1.1, it provides an alphabetized listing of every word, number, command and punctuation mark in a program, with a cross-reference of the lines in which each appears.

Editing a program line has been made very simple. The operator enters a line number, and the relevant line is completely deleted from the program. Corrections are made just by typing in a new line. Level I had this feature—why has it taken so long to come to us Level II and Disk BASIC users?

DROSSDOS File Handling Capabilities

In their quest for simplification, the Kitchen Table software crew has come up a winner again. I found DROSSDOS' file handling perhaps the simplest to learn of any DOS, ever. There aren't any! Instead, all values are stored in variables within the programs themselves. Then, when an input session is completed, BASIC simply transfers the entire contents of memory—all 32 or 48K of it—to disk. The next time the program is run, DOS loads all of memory back where it belonged with all registers intact. In fact, the system uses buffers only to keep the CPU from getting a headache.

There isn't room in one article to explore all the features of DROSSDOS 1.1. If this innovative new operating system proves popular, you can be sure that there will be followup reports. ■



NEW PRODUCTS

edited by Bert Latamore

Lifeboat Publishes Buyer's Guide

Lifeboat Association's new buyers' guide and catalog lists 50 media formats, CP/M compatible disk operating systems, hard disk integration modules, system tools, telecommunications systems, languages, language and application tools, word processing systems and aids among other subjects.

It is available from the Catalog Department, Lifeboat Assoc., 1651 Third Ave., New York, NY 10028.

Reader Service ✓ 330

MOG Automates Mail Ordering

MOG (Mail Order Generator) for the TRS-80 Model I and III completely automates making mail orders.

It prompts you for all order information, allows a review of your order and complete editing, sorts the order by any of five variables, totals the order, adds tax and postage, saves the order on cassette, and drives a 32-, 40- or 80-column printer.

It supports lowercase on the Model III and requires at least 16K of memory, but will use up to 48K RAM for longer orders. It costs \$10 from Practical Programs, 1104 Aspen Dr., Toms River, NJ 08753.

Reader Service ✓ 331

Program Figures Feed Costs

A new user-developed program for the Model I or III with 48K memory and a 132-column printer will store animal feed formulae, figure protein, fat, fiber, etc. for each formula and keep the price of each formula up-to-date with grain market prices.

The formulae are easily edited, deleted, added, displayed and printed and ingredients can be changed easily.

The program is available for \$75 from Thomas R. Broussard, PO Box 2577, Lafayette, LA 70502.

Reader Service ✓ 332

Free Catalog Lists 200 Products

Creative Computing's new 48-page catalog lists more than 200 computer-related products including 20 books on programming, games and educational applications, 160 software packages, three magazines, five graphics and music peripherals, an LP record, a board game, eight T-shirts and an assortment of other products.

The 48-page publication is free from Creative Computing, 39 E. Hanover Ave., Morris Plains, NJ 07960.

Reader Service ✓ 184

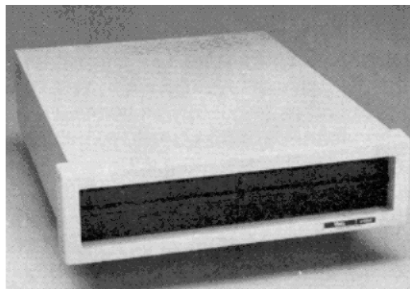
Dual 8-Inch Drive Offered

The V1000 dual eight-inch drive subsystem accommodates mass storage units ranging from single-sided eight-inch floppies to 20-megabyte streaming tape cartridges and 40-megabyte Winchester disk drives.

A sliding-chassis design gives easy access to the drives.

It is available with a choice of drive configurations. Prices range from \$1,095 to \$2,295 from Vista Computer Co., 1317 E. Edinger Ave., Santa Ana, CA 92705.

Reader Service ✓ 329



V1000 Dual 8-Inch Disk Drives

Data Conversion Achieved

Prestige Marketing Corporation is offering a data conversion service which will

convert data from one system disk to that of another system.

For instance, Prestige can convert data from IBM 3740, DEC RT-11 and Apple II to TRS-80 disks and vice versa.

Information is available from Prestige Services Division, 909 N. Coliseum Blvd., Fort Wayne, IN 46805.

Reader Service ✓ 333

Program Tracks Accounts Receivable

ACCT-M3 carries the accounts receivable functions for a small business or medical clinic using initialization, account manager and report generator programs.

Data bases are limited only by the number of disks you own.

Designed for a dual-disk, 32K minimum memory, Model III with TRSDOS, it costs \$69 from Micro Architect Inc., 96 Dothan St., Arlington, MA 02174.

Reader Service ✓ 171

Programs Published

A book of BASIC programs for the TRS-80 has been released by Sams Books.

The 168-page book has completely tested and debugged programs in home use, educational and business use areas ranging from an automatic telephone dialer to a checkbook balancer.

The book *Mostly Basic: Applications for Your TRS-80* costs \$10.95 from Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, IN 46268.

Reader Service ✓ 334

Program Tracks Portfolio

Options-80 allows the TRS-80 to analyze investments for maximum return.

The program handles buying and selling listed call and put options, spreads and shares, analyzes impact of commissions, cost of money, dividend and risk exposure, and projects an annualized percentage return on investment as a

SUPER DISCOUNTS ON ALL COMPUTER EQUIPMENT

16K MEMORY ONLY \$25.95!

For TRS-80 Keyboard or Expansion interface. KEYBOARD requires jumpers: \$2.00 Extra. These are 200 ns tested RAM for the TRS-80, APPLE or EXIDY.

DISK DRIVES for the TRS-80 OR PMC-80:

All of our drives come complete with power supply and chassis. They may be used with existing Radio Shack drives on the same cable! 40 track drives store 102K bytes single density, and 175K double density. 80 track drives have 175K single density and 345K double density! All drives guaranteed 90 days, one year on power supply.

40 track MPI drives	\$319.95
40 track TEAC drives	\$315.95
40 track TANDON drives	\$319.95
80 track MPI drives	\$449.95
80 track TEAC drives	\$429.95
2 drive cable	\$ 25.95
4 drive cable	\$ 39.95
NEWDOS 80 OPERATING SYSTEM	\$139.95
NEWDOS 80 PATCH Patches NEWDOS 80 to work with single or double density and the doubler.	\$ 59.95

PERCOM'S DOUBLER for double density operation!

The DOUBLER works with the TRS or PMC expansion interfaces to allow you to use your drives in double density! You may still operate your drives as single density also! Comes with DBLDOS operating system which allows you to transfer single density files to double and vice versa! **GREAT BUY!**

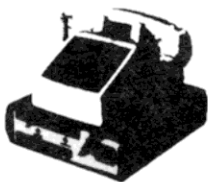
DISKETTES: VERBATIM DATALIFE! BOX OF TEN SOFT OR HARD SECTORED 5 1/4"

WE HAVE DRIVES AND CONTROLLERS FOR THE MODEL III. CALL FOR PRICES!!!

MODEMS AND TELECOMMUNICATIONS

LYNX Telecommunication system for the TRS-80 and PMC-80

Includes terminal software and connections for instant hookup! Can be connected to the TRS-80 or PMC-80 with or without an expansion interface!	\$279.95
LEXICOM MODEM 300 BAUD Requires RS-232	\$169.95
THE SOURCE: Hook-up to the "SOURCE"	\$ 99.95
ATARICONNECTION: Modem for 400/800, complete with software!	\$249.00
APPLECONNECTION: Modem for APPLE II	\$279.95



COMPLETE SYSTEMS:



PMC-80, 16K LEVEL II COMPUTER.....\$739.00

The PMC-80 is a work alike to the TRS-80 mod I computer! Comes with Microsoft's BASIC in ROM. Built in cassette. 12" video monitor. Expandable to 48K.

Compatible to All TRS-80 MOD I Programs.

PMC 80 without monitor

RF-MOD for PMC to TV hookup

PMC-80 EXPANDER 100 SYSTEM

INCLUDES: 32K memory, S-100 bus, RS-232 interface, Parallel printer driver, Disk controller. Fully compatible with TRSDOS, NEWDOS, VTOS, and all other TRS-80 Mod I disk software!

APPLE II COMPUTERS 48K

ATARI 400

ATARI 800 COMPUTER

ZENITH Z-89 48K, 1 DISK ALL IN ONE COMPUTER

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Comes with friction and pin feed. upper/lower case, Graphics.

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TRS-80 DISK and other mysteries

ZBASIC BASIC COMPILER for MOD I and MOD III TRS-80 and PMC-80 Increase basic program speeds by up to 200 times!!!!

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function of annualized percentage growth in share value. It displays results in graphical and tabular form on video display or printer.

The program, for the Model I or III, 32K, on disk or cassette, costs \$125 from Options-80, PO Box 471, Concord, MA 01742.

Reader Service ✓ 335

Book Discloses Structures

Structured Requirements Definition by Ken Orr is a presentation of recent advances in systems theory, tools and methodology in a readable text.

The book is available from Ken Orr and Associates, Inc., 715 E. 8th St., Topeka, KS 66607, for \$25.

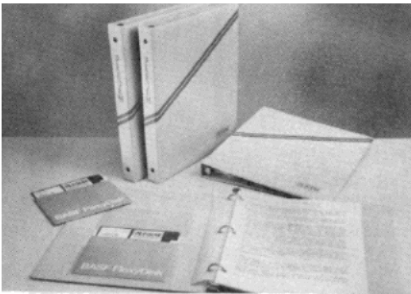
Reader Service ✓ 336

Percom Sells Binders

Percom Data Co. is offering three-ring binders with two inside clear plastic diskette pockets designed for software documentation.

The light tan binders, decorated with the Percom logo and designer stripes, sell for \$4.95 from Percom Data Co., 211 N. Kirby, Garland, TX 75042.

Reader Service ✓ 172



Percom Binders

Target Helps Business Planning

The Target business planning system is designed to replace time-sharing and large-scale systems for the small business in the analysis of past business activities and projection of future performance.

Advanced features include an ability to display or print the entire set of data entries, calculation rules and report specifications for error correction and the ability to follow English commands instead of matrix algebra commands.

It runs on the Model II with at least 56K memory and 200K disk storage using a CP/M operating system.

Created by Advanced Management Strategies Inc., Atlanta, GA., it is available from WESTICO, 25 Van Zant St., Norwalk, CT 06855 for \$195.

Reader Service ✓ 174

Muse is Word Processing Program

Muse provides extensive word processing operations for ANSI Fortran-compatible computers including full-screen cursor control, automatic or manual pagination, letter, report and manual formats, block editing and erasure, page headers and feet, superscripts and subscripts, and multiple overlays for composite characters.

It runs on a variety of CRT terminals and outputs to all popular correspondence-quality printers.

A Muse package supporting one to three work stations and one terminal printer on perpetual lease is available for a one-time payment of \$6,800 from Marc Software International, 260 Sheridan Ave., Suite 412, Palo Alto, CA 84306.

Reader Service ✓ 173

Centronics Offers Graphics Printer

The Model 739 is a graphics printer with a 74-by-72-dot per inch resolution, a mono-spaced print speed of 100 cps, and an acoustical top cover for single sheet loading and noise suppression.

It is available for less than \$1,000 from Centronics Data Computer Corp., Hudson, NH 03051.

Reader Service ✓ 337

Program Interfaces PC, Models I and III

Pocket Tape I is a machine language program allowing the TRS-80 Models I and III to read data tapes recorded by the Pocket Computer.

The Model III versions may be used directly on a cassette- or disk-based machine. The Model I versions require an external hardware interface to the PC tape format. Minimum system memory is 16K.

The program costs \$14.95 on cassette and \$24.95 on disk, and the Model I cassette interface is available for \$49.95 as-

sembled and tested (or it may be built from Radio Shack parts according to the included schematic) from Green River Systems, PO Box 552, Auburn, WA 98002.

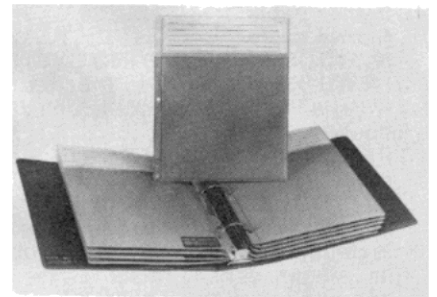
Reader Service ✓ 185

Envelope Protects Data

Data-Safe is a metallic shielding alloy envelope designed to shield two floppy disks from magnetic fields during storage. Each page fits in a three-ring binder.

They are \$8.95 each for orders of five, or less with discounts for larger orders from Data-Safe Products Inc., 1926 Margaret St., Philadelphia, PA 19124.

Reader Service ✓ 160



Data-Safe

Select Word Processor Features Easy Operation

Select is a word processing program compatible with CP/M using microcomputers.

It features single-key instruction entry and the creators claim it takes only 90 minutes to learn to use it.

It costs \$600 from Select Information Systems Inc., 919 Sir Francis Drake Blvd., Kentfield, CA 94904.

Reader Service ✓ 180

Program Teaches Even-Odds Play

Tired of losing money at casino blackjack tables? Basic Strategy Tutor I will teach you even-odds play using Las Vegas strip, Las Vegas downtown and Reno-Tahoe rules, with or without double down after splits option, with single or four decks.

It features moderate and advanced speed play options and tracks the number of hands played, number of hands played correctly, number of blackjacks dealt and

strategy accuracy percentage.

It is available for \$24.95 on cassette for a 16K machine or \$29.95 on disk for a 32K machine plus \$2 shipping and handling from Micro BlaJak Systems, Inc., 2800 N. Ellen St., Flagstaff, AZ 86001.

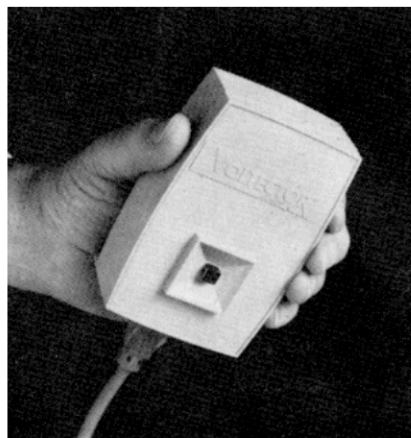
Reader Service ✓ 175

Regulator Stops Volt Surges

The Voltector protects microprocessor-based equipment from power surges, spikes, transients and high frequency interference. It meets latest industry surge voltage standards and gives two-way protection, preventing the microcomputers from causing line problems as well.

It is available for \$79.50 from Pilgrim Electric Co., 29 Cain Dr., Plainview, NY 11803.

Reader Service ✓ 161



Voltector

M-Zal is Editor/Assembler

M-Zal is a modular editor/assembler for the TRS-80 Models I and III which includes full screen option menus, full screen text editor, and object module linker.

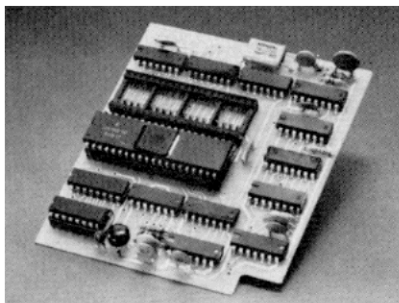
M-Zal is available for \$149 from Computer Applications Unlimited, PO Box 214, Rye, NY 10580.

Reader Service ✓ 165

Run Model III Disks On Model I System

Doubler II is an update of Percom's Doubler double-density disk system adaptor for Model I computers.

Like the original, the new version allows



Doubler II

as much as 364K bytes of storage per side of a five-inch diskette, four times that provided by an unmodified Tandy Model I drive.

Unlike the original, this version allows the Model I to use Model III diskettes. The Model I cannot do this without modification.

Doubler II costs \$219.95 including a DBLDOS Diskette. The upgrade kit for Doubler I costs \$30 with proof of purchase of Doubler I. It is available from Percom Data Co., 211 N. Kirby, Garland, TX 75042.

Reader Service ✓ 181

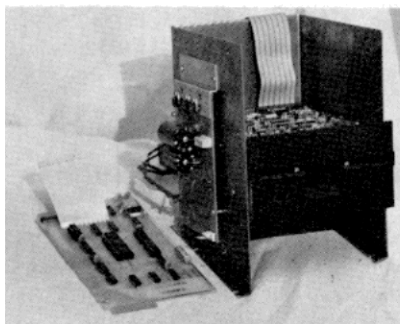
VR Data Announces Disk III

Disk III, from VR Data, is a five and one-quarter-inch disk storage subsystem that is 100 percent compatible with the Model III hardware and software.

Installation can be done by VR Data or by any mechanically-inclined person with hand tools. Disk III options include a second internal 40-track drive, an 80-track disk driver, a two-sided 40-track drive, and a two-sided 80-track drive.

The price for a basic unit is \$599, the second 40-track drive is \$265. Disk III is available from VR Data Corp., 777 Henderson Blvd., Folcroft, PA 19032.

Reader Service ✓ 328



Disk III

Convert Color Programs to Cartridge

TRS-80 Color Computer owners can have their programs on cassette put into a ROM cartridge, giving them instant loads. Eigen Systems will do this transfer with any Color BASIC or Extended Color BASIC program.

The ROM cartridge plugs into the Color Computer's external port. The program will run instantly upon power-up, and all memory can be used for data storage or graphic displays.

Prices start at \$45 from Eigen Systems, Box 10234, Austin, TX 78766.

Reader Service ✓ 338

Board Doubles Color Computer Memory

Ramcharger is a completely assembled and tested printed circuit board which fits inside the Color Computer to increase its memory from 16K to 32K.

Completely compatible with Color BASIC, it requires no special software, no soldering or hardware modifications and leaves the ROM Pak port free.

It comes completely documented for \$99.95 from Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466.

Reader Service ✓ 177

Raiders Has Fast-Moving Animation

Space Raiders is a high-speed space battle game which puts the operator inside a spaceship on a search and destroy mission to intercept a Klingon convoy.

It features arcade-style simulation and gives a different game each time using a TRS-80 Model I, 16K Level II machine.

The game costs \$24.95 from Bosen Electronics, 445 East 800 North, Spanish Fork, UT 84660.

Reader Service ✓ 164

A Walk on The Monster Side

Crush, Crumble and Chomp gives the game player the opportunity to be a monster, literally.

The player chooses from among several famous Grade B Movie monster greats or, in the disk version, he may create his own monster to invade New York, Washington DC., San Francisco, or Tokyo. He battles tanks, infantry, helicopters and mad

NEW PRODUCTS

scientists while trying to achieve his goals.

The player can choose from five goals: destroy buildings, destroy combat units, survival, eat or just blast everything in his path.

The game comes on disk (TRSDOS 32K) or cassette for \$29.95 from Automated Simulations, PO Box 4247, Mountain View, CA 94040.

Reader Service ✓ 183

ASC Has New Program for Livestock

Agricultural Software Consultants, Inc., offers a new least-cost ration balancing program called Mixit-1. Mixit-1 can be set up for any type of livestock and comes with a 15-day money-back guarantee.

The program uses a machine language linear programming model to get a true least-cost ration quickly. In 16K Level II BASIC you can run Mixit-1 with 30 feed ingredients and 10 restrictions, and it is expandable to 32K.

The program costs \$95 on cassette or \$99 on diskette from Agricultural Software Consultants, Inc., 1706 Santa Fe, Kingsville, TX 78363.

Reader Service ✓ 326

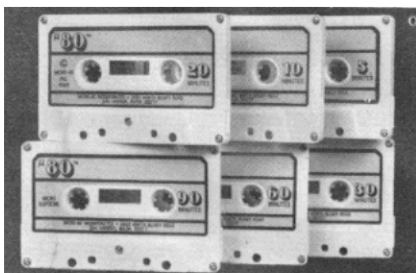
C-5 Tape is Quicker

Micro-80 now offers a cassette tape format designed for higher baud-rate systems. The Micro-Data C-5 five minute cassette allows over 24,000 bytes of storage per side at 1500 baud.

Compared to the C-10 cassettes used on the Model I, the C-5 will store more data in less space and less time. These capabilities make the C-5 ideal for the TRS-80 Model III and the Color Computer.

For more details write Micro-80, Inc., E-2665 North Busby Road, Oak Harbor, WA 98277.

Reader Service ✓ 325



C-5 Cassettes

Exchange Offers Demo Tapes

Computer Information Exchange Inc. is offering demonstration tapes on music synthesis on the TRS-80 and compilers in BASIC and Tiny Pascal, a tape head azimuth alignment tape, and an update on their SuperPimx data-base management program.

The music tape, designed for play on a high fidelity system, compares the performance of two synthesizer boards in popular and classical music including Bach, Handel, Mozart and Rossini pieces.

The compiler tape demonstrates how use of a compiler speeds play of two games, one in BASIC and the other in Tiny Pascal.

The head alignment tape, which has a 10K Hertz tone on one side and white noise on the other, allows the user to adjust his tape recorder head for maximum alignment by simply adjusting it to the maximum volume.

These tapes are \$3.95 each.

The data-base manager is an update of a popular management system. The update has added pagination, easy accommodation of machine-language drivers, ease of editing fields or records, merge or split files, menu-driver memory management and user-chosen limits of number of fields.

SuperPimx is available on cassette for \$19.95.

All these tapes are from Computer Information Exchange, Inc., Box 159 San Luis Rey, CA 92068.

Reader Service ✓ 179

OASIS Publishes Programs

Volume I of the OASIS Users' Group public domain software collection includes 12 games, a purge utility, a poetry generator and a loan amortization program on eight-inch diskettes.

Membership costs \$35 including the package and is available from OASIS, PO Box 2400, Santa Barbara, CA 93120.

Reader Service ✓ 176

Memory Expander Plugs In

International Memory (IM) is a memory expansion board that will give the TRS-80 Model I up to 48K without an expansion interface, soldering or trace cutting and without software or any alteration of the micro's functions.

Two versions of the board, which plugs into the RAM sockets inside the keyboard unit, are available. The IM-1 gives a 32K byte capacity with 4K or 16K RAM chips and costs \$47.50; the IM-2 gives up to 48K bytes with 16K RAM and costs \$79.50. RAM chips are \$32 per 16K bytes.

All are available from Holmes Engineering, 6246 W 3705 S, Salt Lake City, UT 84120.

Reader Service ✓ 163

Graphing Program Available

Automatic Graphing of Functions is a fast, low priced program which graphs equations in the form $Y = mx + b$ and $Y = (x)$.

It can graph simple formulas, multiple equations, summations, etc., automatically scales its axis for screen display size, has an LPRINT option for a lineprinter and has error handling to take care of tricky equations. It has manual or automatic range selection.

The program with user's manual for the TRS-80 Model I, Level II and Model III BASIC are \$19.95 on cassette from David L. Modney, 4144 N. Via Villas, Tucson, AZ 85719.

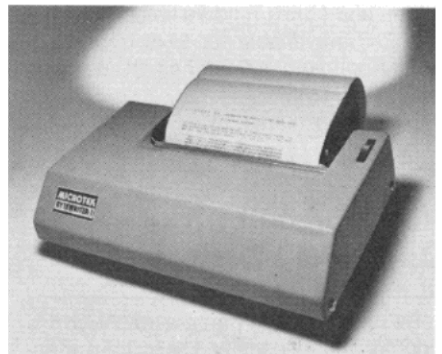
Reader Service ✓ 169

Printer Uses 7 x 7 Dot Matrix

The Bytewriter I is an 80-column dot matrix printer that accepts single sheet or roll paper up to 8½ inches wide and prints at 60 lines per minute using a 7X7 dot matrix.

Designed to interface with all TRS-80 models, it retails for \$299 with a limited 90-day warranty from Microtek, Inc., 9514 Chesapeake Dr., San Diego, CA 92123.

Reader Service ✓ 162



Bytewriter 1



Invasion Orion: Can You Defeat The Klaatu and Your Computer?

Look your computer straight in the eye, load in the new **Invasion Orion** and suddenly you are the Fleet Admiral, the Commander-In-Chief. And only you can stop the alien forces: the robotic Klaatu who have just invaded your Stellar Union space.

You command as many as nine starships; each ship spends energy on moving, on shielding itself, on firing its three weapon systems—destructor beams, missiles, torpedoes. There are 30 different types of starships—all armed with such a fantastic array as to intimidate the Klaatu.

But it isn't as easy as it seems. Your ships have only a limited amount of energy and you must decide how to allocate that energy to destroy the enemy. Will your ship's armor be enough to stop the enemy's torpedo? Or should you divert energy from your weakened to your shield? Move in for the kill on your weakened opponent and risk a beam attack? Or outrun the enemy? With each turn you take, your energy is replenished. Can you defeat the Klaatu? Or is your computer smarter than you are?

Invasion Orion is an EPYX game. Like all EPYX games, you will never get bored playing. Not in your or your computer's lifetime. Every game is different and fresh. Choose from three levels of skill: beginner, intermediate, expert. Ten fully tested scenarios, from one-on-one starship combat to full scale battle. Two programs: the first uses your pre-created scenarios to play the game; the second lets you create your own scenarios and design your own ships. A game that is infinitely expandable.

Yet so very easy to learn. With any of the ten scenarios, the computer takes care of all the details; no complex rules to

remember. The screen shows prompts for your battle orders. Just concentrate on your strategy for victory. Complete with superb graphics (if you have either an Apple or an Atari, you can enjoy color and sound!) and with battle manual, game program, scenario creation program, data files for your computer.

Invasion Orion. Another bug-free, easy-loading lifetime computer game from EPYX. With the unique EPYX lifetime warranty: If anything happens to your cassette or disk at any time and for any reason, send it back with just \$5.00 for shipping and handling and we will send you a brand new one.

(Of course, there is also our 30-day unconditional guarantee: If your EPYX game has any defect whatsoever within 30 days of purchase, return it to us or your dealer and we will replace it free. No questions asked.)

Visit your dealer now and pick up **Invasion Orion** in its good-looking, protective box with the best instruction book you've ever read. Now available on disk for the Apple II (48K RAM with Applesoft) and Radio Shack's TRS-80 (32K RAM). Or on cassette for the Atari (32K), TRS-80 (Level II, 16K), Apple (16K and Applesoft) and Pet (16K). Only \$24.95, disk or cassette.

If your dealer is out of stock and you can't wait, order directly from Automated Simulations. \$24.95 plus \$2.00 for shipping and handling (and sales tax if you are in California).

We guarantee you will be delighted with **Invasion Orion**. (If it is not exactly what you want, return it to us for full refund. Again, no questions asked.) Enclose your check. Or if you order by Visa or MasterCard, use our toll-free phones: In the United States: operator 861 (800) 824-7888; In California: operator 861 (800) 852-7777; In Hawaii and Alaska: operator 861 (800) 824-7919.

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Program Analyzes Phone Bills

Long Distance Analyzer streamlines telephone bill accounting by identifying where your calls go, grouping calls, and totalling those groups for cost accounting, client billing and investigating unfamiliar numbers.

Usage patterns are identified by area code, state and WATS zone.

Cassette version for Models I and III is \$95; disk is \$135. Disk for Model II is \$155, from Golden Braid Software, PO Box 2934, Sarasota, FL 33578.

Reader Service ✓ 166

Micro Link Manages Communication

Micro Link enables inter-computer communication by allowing files to be prepared in advance and transmitted auto-

matically, automatic data-base scanning, the recording of items of interest to the user for later reading, and several options with default settings and simple, fast user commands.

It runs on a 16K Z-80 machine using Micropolis DOS or CP/M 1.4 and up (inquire about TRSDOS, etc.) and costs \$89 from Wordcraft, c/o Microcomputer Software Assoc., 1122 B. St., Hayward, CA 94541.

Reader Service ✓ 182

Development System Put on Model III

The PDS assembly language development system uses TRSDOS on the Model III to provide a macro assembler, linkage editor/linking loader, string-oriented text editor, interactive editor/assembler, trace debug/monitor, disk disassembler and several other utilities.

The system is available on five-inch double-density disks with 100 pages of documentation for \$99 from Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107.

Reader Service ✓ 178

Foto-File is For Photographers

Tape-Tronics is offering two software packages for photographers.

Foto-File organizes slide, negative or print album files by title, location, category or code and costs \$19.95 for cassette and \$29.95 for disk.

Darkroom Assistant is a three-program package covering prints from slides, negatives or Cibachrome process giving correct filtration values, exposure times and developing temperatures. Cost is \$59.95 for tape or diskette from Tape-Tronics, 346 N. Western Ave., Los Angeles, CA 90004.

Reader Service ✓ 168

ACCEL2 SPACE TRADEOFFS

Compiled programs run faster than uncompiled programs but they are usually bigger. This is because compiled statements occupy more space than the BASIC source statements they replace. ACCEL2 compiles a selected subset of Level II/Disk BASIC and controls the interpreter to execute uncompiled lines at normal interpreter speed. The uncompiled lines stay exactly the same size and thus do not contribute to code growth at all.

Table below shows the BASIC subset translated by ACCEL2 to machine code. Figures represent the number of extra bytes needed by each instance of the compiled instruction.

	INTEGER	SINGLE	DOUBLE	STRING
Assignment (LET)	5	14	14	14
Array Reference (1-dim)	16	24	25	20
AND or OR	5	14	14	14
Compare (<, >, etc)	11	26	25	10
Add, Subtract, Concat	5	2	2	1
Multiply (*)	5	2	2	1
Divide (/)	5	2	2	1
Reference to a constant	0	6	10	7
FOR with NEXT	29	19	19	18
POKE	7	18	18	21
SET or RESET	6	21	21	18
IF THEN ELSE	15	18	18	18
ON expression GOTO	12	18	18	18
Functions				
VARPTR	-3	-9	-9	-9
POINT	3	9	9	9
PEEK	0	0	0	0
LEN				1
MID\$				5
LEFT\$				4
RIGHT\$				4
CHR\$				2
ASC				7
CVI				8
Flow of Control				
GOSUB with RETURN	4			
GOTO	0			
All other BASIC statements and functions	0	0	0	0

The ACCEL2 user may also selectively inhibit compilation of expressions to further minimize code growth. This is controlled by embedding REM NOEXPR and REM EXPR lines in the uncompiled program to bracket performance critical sections. Programs compiled without use of the REM NOEXPR option typically expand to about 1.5-2.5 times the size of the original, but since ACCEL2 strips REM statements from the BASIC program, final size can sometimes be smaller.

ACCEL 2: For 32K TRS-80 Model I (Model III version soon). Compile-time size 5652 bytes, run-time size 1536 bytes, save to ES/F walter, disk under TRSDOS, NEWDOS, NEWDOS80.

TSAVE: Writes ACCEL2 compiler output to independent SYSTEM tape. Developed in Britain by Southern Software. \$88.95 + \$2.00 shipping. \$9.95 + \$1.00 shipping. Mastercharge/VISA CA add 6%.

Allen Gelder Software, Box 11721 Main Post Office, San Francisco, CA 94101. (415) 387-3131. ✓ 79

TRS-80, TRSDOS tm Radio Shack. Stringy/Floppy tm exatron inc. NEWDOS tm Apparat, Inc.

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ADD lowercase with our PLUG-IN piggyback board!

9WX7H Dot Matrix \$135
5WX7H Dot Matrix \$ 95

TWO complete character sets on board:

96 character ASCII **PLUS** choice of
128 character APL, TRS-80/H-19 Graphics or
Scientific. (Customer defined: add \$50/set).

Most printers convertible: specify logic board #

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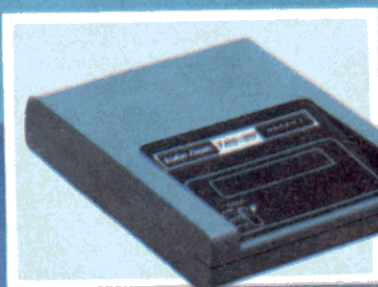
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Disk Drives and Interface—top end hardware for Model I connoisseurs.

Lobo Connections

LX-80
Lobo Drives International
Goleta, CA
\$862
SA800
\$1342

by Jake Commander

Though Lobo Drive's LDOS may already be a familiar name to disk operators, the equipment for which it was designed—the LX-80 expansion interface and the SA800 dual eight-inch disk drive—remain unexplored.

Why bother with a more expensive alternative to the Radio Shack expansion inter-

face and drives? First, an unmodified Radio Shack interface won't accommodate eight-inch disks, whereas the LX-80 will. Also, since production of the Model I has ended, it's anyone's guess as to how long the attendant interface equipment will remain available. Despite such a threat the Model I is thriving, with reports of units being sold for more than they cost new. Manufacturers of ancillary gear are not merely continuing to support the hardware, but in some cases are offering superior alternatives.

Offers Reliability

I've been operating the Lobo equipment on my system for over two months without a single glitch. This reliability, reflected in the stiffer price, has also been built into the equipment.

Lobo engineers employed a good degree of overkill in their designs. For instance, try lifting the interface. Instead of a plastic case, both interface and drive units are enclosed in one-eighth-inch thick steel. Not that many users are likely to try it, but you could quite literally drive a car over the interface without damaging it.

The unit measures just under three inches high (lower than the RS expansion interface), by 19 inches wide, by 12 inches deep. Photo 1 shows how the interface looks in typical setup.

The LX-80 comes with a user manual which not only describes set up procedures, but offers the reader simple step by step diagrams. An enthusiastic owner who dabbles first, without reading, can plug in either the five or eight-inch drive connector cables the wrong way; neither the multi-pin plug nor the socket have a keying notch. Not that this is likely to damage anything, but, considering Lobo's high degree of engineering, this is a curious omission.

The manual also tells you how to change the LX-80's parameters to fit your needs. Furthermore, owners are actually told how to open the box and install up to 32K of their own RAM. The only criticism I have of the manual is that there is no circuit schematic. I don't care how secret Lobo's circuit design is, if someone wants this sort of quality, and pays this sort of price, he should have the option to maintain his own equipment. This is obviously impossible without the circuit diagram.

The interface may be powered from either 117 VAC at 60 Hz, or 235 VAC at 50 Hz. The manual tells you how to make the change by replacing a strap inside the unit. This dual-standard power supply is a blessing to foreign users. I speak from experience. I blew two Radio Shack power units while in Europe.

An extra bonus from the LX-80 is that it can also supply power directly to the TRS-80 keyboard, allowing it to run cooler.



Photo 1. Lobo's LX-80 Shown in Typical Setup

"The LX-80... can also supply power directly to the TRS-80 keyboard, allowing it to run cooler."

Thus, you can exchange Tandy's plastic power units for Lobo's higher reliability. This is especially useful when operating the TRS-80 in a high ambient temperature when the back of the keyboard can become frighteningly hot.

Disk Mix

The unit is extremely flexible regarding the disks you can use. If you want to use four five-inch mini-floppy drives or four eight-inch standard floppy drives, the LX-80 will support it, or any combination. Not only that, but it's possible to configure the interface to boot up from either five- or eight-inch drives.

Even this doesn't cover all possibilities because the LX-80 can also support hard disks, specifically Lobo's 1850T dual fixed/floppy. The fixed disk comes in five- or ten-megabyte versions, the floppy gives up to 1.6 megabytes per disk.

This can be configured as the bootstrap drive. Though this may sound complicated, it's not. The whole point is merely to tell the interface which is drive zero, and this is done by setting small DIP switches at the rear of the unit.

In summation, the LX-80 supports floppies in double or single density, single or double-sided, up to four five-inch disk drives, plus up to four eight-inch drives, plus any number of hard disk drives, and in any combination. Try that with your average expansion interface. You now have the possibility of a huge data base of tens of megabytes connected to the TRS-80.

I need to add one small caveat to this glorious mixing of drives. The LX-80 doesn't map its disk input/output in the same way as does Radio Shack in their expansion interface. Lobo's unit addresses the drives via I/O ports. Radio Shack memory-maps them. This is minor, as that's the way both the Model II and the Model III computers access their drives.

Lobo decided to follow the same course by port-mapping I/O, which is no mean feat, as the ROM bootstrap loader routine in the keyboard unit expects the disk controller to be mapped in memory. The LX-80 appears to cope with this anomaly by flipping to memory-mapped I/O upon reset (which suffices to read the bootstrap sector) then flopping automatically to port-mapped I/O for all subsequent disk accesses.

The upshot of all this is that the few pieces of software written for the TRS-80 that don't perform disk I/O through the disk operating system will not work. Included in this small category are such programs as Super-Utility and certain adventure games which perform their own disk I/O.

This is the reason Lobo International

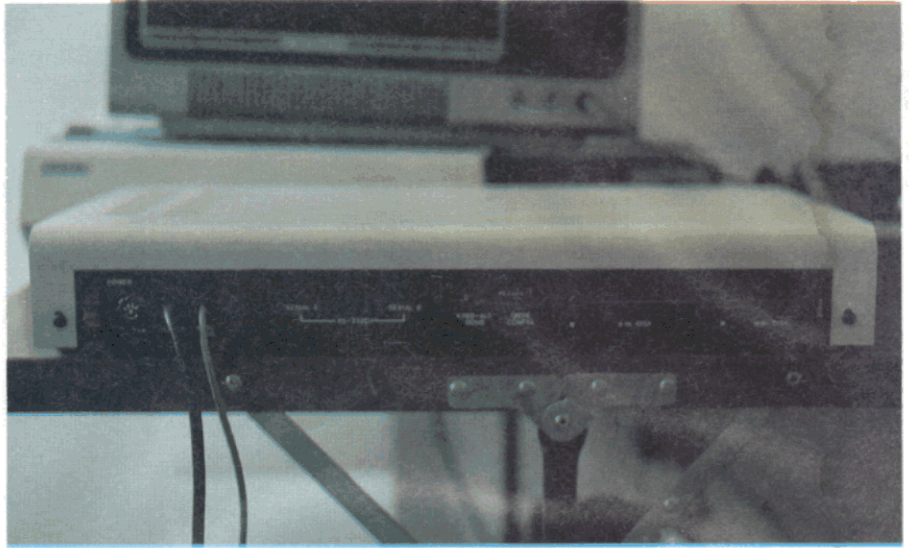


Photo 2. The LX-80 features serial I/O ports, alternate ROM switch, drive zero configuration switch and sockets for connecting five and eight-inch floppies.

needed to have a DOS developed especially for their hardware. All BASIC programs will work fine because the disk accesses are made via the disk operating system, in this case, LDOS. All machine code programs, such as Visicalc or Profile, will work as well. They, too, access disk files via the DOS.

For the curious, here are the ports used for disk I/O in the LX-80. Experienced TRS-80 hardware users will notice several extra options compared to the regular interface.

Port	Input	Output
E0	Hard disk data	Hard disk data
E1	Floppy FIFO data	Floppy FIFO data
E2	FIFO counter	FIFO mode (0-read, 1 write)
E3	DIP switch	Floppy select and modes
E4	FDC status register	FDC command register
E5	FDC track register	FDC track register
E6	FDC sector register	FDC sector register
E7	FDC data register	FDC data register

Other Capabilities

An interesting feature of the Lobo setup is the ability to override the keyboard Read Only Memory. A switch at the rear of the unit switches out the Level II BASIC ROM and switches in an alternate set which can be plugged into three sockets inside.

With the usual flexibility that seems to be part of Lobo's design philosophy, numerous sorts of ROM can be added by reconfiguring a set of jumper wires near the alternate ROM sockets. The kinds of ROM Lobo accommodates are 2708s, 2716s, or 2732s. This should allow the whole TRS-80 to operate with any dedicated application in mind. Possibilities include a Pascal or Pilot that can be available on power-up, or any num-

ber of industrial or mechanical applications.

The LX-80 contains the usual real-time clock which provides interrupts to the Z-80 once every 25 milliseconds in the same manner as the Radio Shack interface. Another similarity is the expansion port which replicates the pinout from the back of the keyboard, except for the five-volt supply on pin 37. This allows you to use the wide range of peripherals available for the TRS-80.

A Centronics-type parallel printer port is memory-mapped to the same address as the ordinary expansion interface, so printing is unaffected. Two serial output ports driven by a Z-80-SIO/2 controller will drive a serial printer. These RS-232 I/O channels can be configured by the user to interface with just about any serial device.

Opening the cabinet, you will see two jumpers, one for serial port A and the other for port B. These jumper plugs can be soldered to allow any serial custom configuration. Anyone who has need of serial I/O has probably come to realize just how non-standard a standard RS-232 bus can be. Lobo's configuration allows handshaking, other control signals or data to appear on different pins to the cable from the outside world.

Baud rates can be set from software, and range from 12.5 baud to 316.8 kilobaud. That should cover just about every possible serial device imaginable.

A description of the jumper plug follows. Note that the left side shows the signals available from the interface, while the right side shows which pins these signals can be

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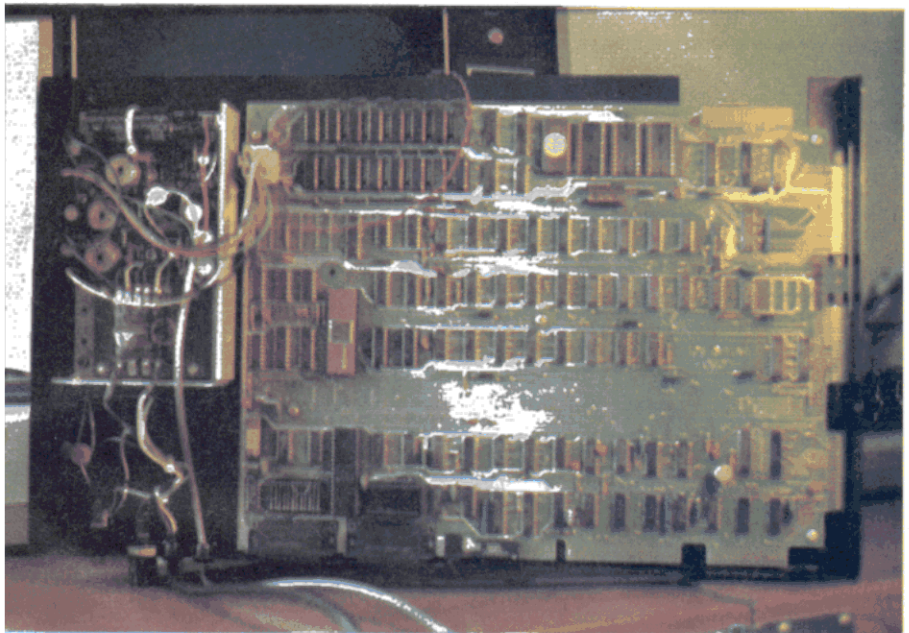


Photo 3. Inside LX-80

routed to on the DB-25S socket at the rear of the interface.

- | | |
|------------------------|-------------------|
| 1. + 12 volts | 24. Not used |
| 2. Transmit data | 23. DB-25S pin 2 |
| 3. Transmit clock | 22. DB-25S pin 24 |
| 4. Request to send | 21. DB-25S pin 4 |
| 5. Data terminal ready | 20. DB-25S pin 20 |
| 6. Receive data | 19. DB-25S pin 3 |
| 7. Receive clock | 18. DB-25S pin 17 |
| 8. Clear to send | 17. DB-25S pin 5 |
| 9. Data carrier detect | 16. DB-25S pin 8 |
| 10. - 12 volts | 15. DB-25S pin 6 |
| 11. Not used | 14. Not used |
| 12. Not used | 13. Not used |

Photo 2 is a shot of the rear of the interface showing the serial I/O ports, alternate ROM switch, drive zero configuration switch and sockets for connecting five- and eight-inch floppies.

Access couldn't be simpler to the 10.5 x 14-inch printed circuit board for adding RAM or changing jumpers. The board is rigid thick glass fiber held down by five screws which should eliminate any flexing problems.

To the right of this PCB is the power supply mounted inside an alloy shield. Photo 3 shows you the inside of the interface. The alternate ROM sockets are visible just right of center at the top of the main PCB, whereas the serial I/O jumpers are at bottom left of the same board. Notice the hefty power transformer.

The SA-800

Though the LX-80 steals the show, the dual SA-800 eight-inch single-sided floppy

disk drive offers over one megabyte of storage in double density. The units are tried and trusted Shugart SA800 soft sector drives which boast a head life of 15,000 hours and a disk life of a phenomenal 3.5 million passes per track.

The cabinet is fairly large by microcomputer standards, measuring 17.5 inches x 22 inches x 4.5 inches with the same hefty construction techniques used for the interface.

Unlike five-inch floppies, eight-inch drive motors are constantly running, whether or not the drive is selected. For this reason, Lobo installed a cooling fan at the back of the cabinet. Unfortunately, for my taste, the fan was noisy to the point of distraction.

The drives themselves function so perfectly it's almost boring. I haven't noticed a soft error in two months.

A Shugart OEM manual is supplied with the drive unit, as well as a maintenance manual that does contain the circuit schematics.

Conclusion

Though the Lobo expansion interface offers much greater versatility versus others currently available, their drives just outperform, or are equal to others now on the market. However, both units are of the highest quality and seem to be aimed at the professional microcomputer user.

OK, Lobo International, when you are going to come out with a TRS-80 compatible keyboard unit? The industry could use one. ■

like the golf pros

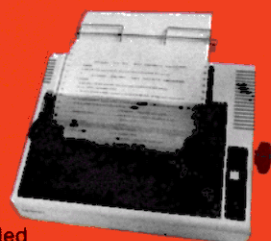
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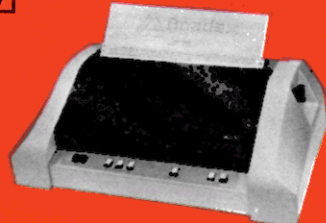
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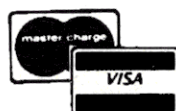
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Though the pundits differ, the users seem clear on the issue.

Microcomputers— Business or Pleasure

by Bert Latamore
80 Microcomputing Staff

TRS-80 microcomputers are business machines, not home computers, according to the official view of Tandy/Radio Shack, Fort Worth, TX. While this idea might surprise many home users, Tandy's market surveys apparently back it up.

"Our primary thrust has always been for the business user," Ed Juge, Tandy's director of computer merchandising, said. "We only advertise to homeowners during Christmas time."

Tandy doesn't make its detailed market breakdowns public, so it is hard to determine just how large Tandy's business market is. However, its last annual report shows its total computer-related sales for fiscal year 1979-80 was 12.7 percent of its approximately \$1.4 billion gross corporate sales or \$175,845,890. This is up from \$19,678,320 in 1978 or 1.8 percent of Tandy's sales.

Yankee Group, Boston, MA, a market research firm, estimates 250,000 business microcomputers of all kinds were in use at the beginning of the year.

Actually this is just the tip of the potential business market. The question is not whether a potential market exists—it is how much of this market microcomputers like the TRS-80 can capture. The answer depends on several variables including the amount of resistance the market has to change, the availability of adequate programs, and the ease with which the machine can be used by the average businessperson.

The experts are split on this issue. Each seems to have a different answer based on a different theory of the future. While they agree computerization is our common destiny, they are not all sanguine over the future of the TRS-80 in business. In fact, some are downright pessimistic.

Not so, for Ed Juge—he believes Radio Shack computers have a great future in the business market based on their record.

"Sales are growing by leaps and bounds," he said. "I think there's not any question that they earn their keep. I talk to people who say they saved the \$4,000 for a Model I disk system in the first three weeks."

Juge said the Model III is designed as a desktop unit for an administrator who wants such things as data base management and word processing at his elbow. The Model II, he said, is intended to run a larger work station.

"The mainframes serve a particular market, and we serve a particular market," he said. "As the micros grow they will undoubtedly move into the mini market."

Even in complex mathematical applications, Juge said, the desktop unit has an advantage over the typically heavily utilized mainframe. The big machine may not get to your program in the three hours it takes the micro to solve it.

Juge predicted business microcomputers will do more communicating with each other and their larger cousins in the future. At Yankee Group, Senior Analyst George Colony expects the local network concept to grow. He predicts desktop computers in the future will normally be connected to a four-level system. The first level will be a mainframe computer—either company-owned or on timesharing. It will store data and run the network, which is the second level. The network will connect it with microcomputers which act as remote processing stations. These are connected with a microcomputer on each desk.

Most actual programs would run on either the micro or the minicomputers.

"The advanced work station (the desktop unit) must be fully compatible with Level III (the minis) and, perhaps, Level I," Colony said. "This cuts out TRS-80 and Apple."

Colony predicted both IBM and Xerox will enter the microcomputer market with units designed to interface with their larger machines. In fact, he said he had heard IBM will have two micros, one in the \$700 range and one costing about \$1,500. If Colony's

highly-structured vision proves correct, these computers will have an overwhelming advantage over micros that are not specifically designed to work as part of such a system.

Colony said the ideal business microcomputer would be multifunctional, componentized and highly intelligent, probably at least 32K bits. It would be very easy to use and self-teaching to the point that a new person could start using it five minutes after he first sat down in front of it. It would be available through retail stores and may have a flat-plane screen.

Colony, like many others, also predicted a strong Japanese entry into the U.S. market this year.

Micros Not Ready

Extensive interfacing capabilities aren't the problem foreseen by Francis O'Reilly, an independent market analyst. His report for Business Communications Co., Stamford, CT, is the most pessimistic of those surveyed. He said the microcomputer and the business market just aren't ready for each other and won't be for 10 more years.

The microcomputer, he said, still requires technical expertise. Most businessmen do not have technical minds. For instance, he talked with one small-business owner who did not understand the need for programs. He thought he merely had to feed the computer data and ask it questions. To be acceptable to such people, the system has to be easier to use, he said.

This is part of a larger problem, he said. Today's microcomputers are too limited in their abilities.

"If you look at larger systems, they have a megabyte of memory and can do a whole chain of functions on a single command," he said. "You have to get more function into the system."

This kind of power, which will allow micros to handle many more applications and which will support a much friendlier system, will not be available until the next generation of microcomputers, he said. He

“...people are learning to use it (microcomputer)... because of what it can do.”

does not expect this to be on the market in this decade.

Therefore, he predicts only 2,355,000 microcomputer units with a total retail value of \$10,007,000,000, will be sold in the 1980s.

The next decade will be a different matter, he said. By then the new generation of microcomputers will be available. A new generation of people, the children who are learning to use the microcomputer in school today, will be entering the business market as well.

“In the 1950s, when a woman went into her first job from secretarial school, she told her boss she needed an IBM typewriter like the one she learned on,” O'Reilly said. “He got her one. The same system will work

here.”

In O'Reilly's model of the future many microcomputers will stand alone. Therefore, while easy interfacing with larger machines is desirable, he doesn't see it as being of overwhelming significance.

Limited Only by Programs

The microcomputer market is here, according to Tom Arnett, market analyst for Creative Strategies, San Jose, CA. His views are much more optimistic. He believes the market is limited mainly by available programming, but also by the ease, or lack of ease, with which you can use the machine.

“The typical machine has atrocious documentation,” he said, “but people are learn-

ing to use it anyway because of what it can do.”

Arnett defined the microcomputer as a machine costing less than \$15,000. He said in 1979 about 350,000 of these were sold with a total retail value of \$650 million. By 1984 he predicted sales will grow to \$3.8 billion annually.

Tandy, he said, has a large portion of this market although their machines are on its low end. He said they are sixth in number of units shipped but second in profit generated.

“The reason Radio Shack has been so successful is their 7,000 outlets,” he said.

He said microcomputers will be used more and more in both network and stand-alone situations. If IBM does enter the mar-

In 1979, Dr. Henry Lee, President of Lee Pharmaceuticals, South El Monte, CA, bought a single TRS-80 Model I so he could learn something about programming.

His main aim was to learn enough to allow him to arbitrate between the head of his data center, an MIT graduate with an MBA from Harvard, and that man's assistant, who holds a Ph.D. in chemical engineering from the California Institute of Technology. The two often disagree, based on different visions of the role the firm's Basic/400 730 minicomputer should play in the business.

“The question was whether we would have several small computers or one mini in the company,” Dr. Lee said.

From that modest initial commitment, Lee Pharmaceuticals' involvement in microcomputers has grown. Today, they own about 45 Model Is, Dr. Lee said. They are used by everyone from scientists to salesmen and for everything from research to direct computer to computer supply ordering.

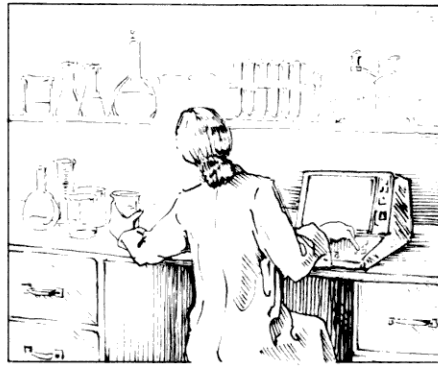
The first thing Dr. Lee tried with his micro was word processing. They had just tried and failed to add a word processing capability to the Basic/400.

“Once we got into them and modified my first one for upper and lowercase, I discovered what a fine typewriter it was,” Dr. Lee said. “I decided if I could buy them cheap enough I would go to them and have my scientists do their own typing.”

He hoped this would speed up the process of getting reports out and eliminate the chronic problem of late reports. Dr. Lee bought them in lots of 10.

They solved the report problem, but Dr. Lee found this was just the tip of the iceberg.

“The sales reps and manufacturing peo-



ple and even our secretaries wanted them he said.

The word processing application, alone, has made them worth their expense, Dr. Lee said.

“It beats distributive processing and terminals on big machines,” Lee said. “You don't have to worry about the response time.”

At the same time, he said, they “liberated the executive from the tyranny of the secretary.”

Dr. Lee and several of his executives have Model Is at home, and others sometimes take them home overnight, so they can work at any time they find convenient.

In fact, he said, the company has eliminated half its 12 secretarial positions by attrition since the Model Is came in.

But word processing is only the start for Lee. Virtually every department of this manufacturer of dental and orthodontic materials, biomedical adhesives and artificial fingernails has found uses for them.

Ten are equipped with modems. These are used to talk with Lee's Ventura County plant, 75 miles away, get chemical information from Lockheed's Dialog time-sharing

system and place orders directly to the IBM 370/168 of Van Waters & Rogers, a chemical supplier. Dr. Lee said this has eliminated problems caused by frequent misunderstanding of long chemical names in telephone orders.

The machines are so light that the engineers carry them from building to building and salesmen take Model Is on appointments, Dr. Lee said.

Lee does not buy any hardware from Radio Shack, having found equivalent items at less cost elsewhere. The Model Is are equipped with Matchless disk drives, kit-built expansion interfaces and upper/lowercase adaptors. They use seven Matchless dot matrix printers, six TRS Line Printer IIIs for high-speed printing and eight daisy-wheel letter-quality printers. They also bought five used, modified IBM Selectrics, which turned out to be too slow, and a used Data Trans that has never worked.

On the other hand, Lee depends on Radio Shack for software support. With its 7,000 stores open seven days a week to 9 p.m., Dr. Lee said, Tandy gives him better service than he can get for his big computer, even though he pays a \$1,500 monthly retainer to a service company.

“Most of the utilities are great,” Dr. Lee said. “The good ones include NEWDOS + , NEWDOS 80, Electric Pencil. We like Xtra Special Delivery (a mail sorting program). We are just getting started with The Creator.”

“But at least a third of the chaps are writing their own programs,” Dr. Lee said. “That's where the real power comes: You can write programs for your own situation.” ■

*by Bert Latamore
80 Microcomputing Staff*

"They all agree business software is inadequate."

ket, he said, they will have a great impact. The reason, however, will not be a presumed greater ability to communicate with larger IBM computers. Rather IBM's great marketing ability combined with its reputation will allow it to blanket the market.

"If you were a businessman," he asked, "would you be more likely to buy a computer from IBM or a Radio Shack store?"

Micros have a long-term viability in the business area, he said. Rather than being replaced by minicomputers because businesses want to upgrade their equipment, micros will replace minis in some applications.

"The thing is contagious," he said. "People get hooked on it and discover how useful the thing really is."

Karen Horowitz, market research analyst for Venture Development Corp., Wellesley, MA, sees the business microcomputer market as evolving from the personal computer

hobby. She said Venture has not done a study of the business computer market, but she has written a report on personal computers.

"Personal computers were thought of as a personal hobby at one time," she said. "Then people wanted to play games or write programs. Now businesses are finding if they have more software available they will get more use... The home market is becoming secondary."

Inadequate Software

They all agree business software is inadequate. Quality has to improve, for one thing.

"You have to understand who your potential purchaser is," Juge said. "I think a lot of the secret is to keep it very simple. Computerize what he is probably doing now with a pencil."

Horowitz said businessmen might be re-

sistant to standardized programs that enforce a standardized way of doing things.

"I think the businessman likes to think he's unique," she said. "However, if you can change a few things you do, you can buy a package for a third of the cost of a specially produced program."

Most of the experts agreed standardized programs fitting basic business uses were needed. Juge said, while needs may vary greatly from one industry subject area to another, needs of different businesses within an area—different print shops, for instance—do not. Therefore, programs could be written for each industry.

O'Reilly disagrees. To earn general acceptance, he says programs must adapt to the businessman, not vice versa.

Canned programs won't be attractive to large numbers of firms, he said, "because every company does things a little differently."

Two years ago, Roy F. Weston Inc., West Chester, PA, was in the market for a way to get computer power to 10 regional offices and a variety of temporary field sites around the country.

Their Univac 90/30, a mainframe computer which they bought in 1977, was doing the job at its main office.

However, the only way for the 400 person firm to make this machine available to engineers in the field was to provide them with terminals and use the telephone lines.

Instead, according to Donald R. Milner, manager of computer services for Weston, they decided to try the TRS-80 as a less expensive way of doing the job.

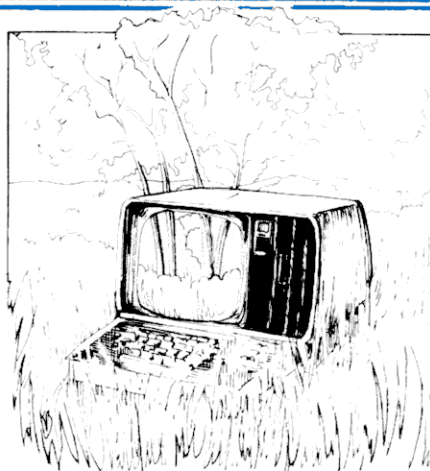
As a result of this decision, four Model IIs of various configurations and six Model IIs, each with a 64K disk drive and one diskette, are operating in a very demanding environment. While problems have appeared from time to time, Milner said the experience has been generally positive.

Weston's micros primarily handle engineering applications. They do operate as word processors at times, but Milner said they are not used for any other normal business functions.

Weston does a lot of environmental engineering. This involves constant air, ground-water and soil sampling.

"Our initial application was to record instrumentation readings (from sampling test instruments)," Milner said. "We've developed a field data management system for sample logging and reporting."

Normally raw data is hand-fed into the machine. However, Weston does have one



automatic setup in which the measuring instruments record their data as audio signals on tape that can be fed directly into one of their Model IIs.

From there it was a natural step to have them perform data reduction and other preliminary data preparation, Milner said. They have moved beyond this to perform sanitary sewer system evaluating and laboratory management on the Model IIs.

"I'm sure they are being used by some of the people to do exotic formulae and so forth," Milner said.

In fact, he said, sometimes they have pushed the micros beyond their limits. But then, he said, they have sometimes exceeded the limits of their 393K Univac and had to go to a time-sharing service to get their problem solved.

They have had to write most of their own programs because they haven't been able

to buy programs for their applications, Milner said. Their main problem in this area, he said, is "human engineering" the system. That mainly involves using the KISS Principle (Keep It Simple, Stupid).

"There are applications that are built to be used by programmers," he said. "You can't give one of those systems to a layman and expect it to work."

On the other hand, he said, the engineers have no trouble adapting to the microcomputers, mainly because they learn to use computers in school.

"An engineer cannot go through school without being exposed to a large amount of on-line computing," Milner said.

The micros face a different kind of challenge in interfacing with a variety of other machines. Wesson has already written a program for interfacing the Model IIs with the Univac. The firm also owns a Tektronix 4045 with two dual-diskette drives, a four-color flatbed plotter and a Wang WP30 dedicated word processor. They plan to tie them together into an integrated system.

Milner said he was basically happy with the Model II as it is. The main change he would like to see in it is a price reduction.

"The situation we will probably continue to run into is matching the micro to the application," Milner said. "We have had the situation where we have asked the micro to do too much and it failed, but that was not the fault of the micro, it was the fault of us. They have their place."

*by Bert Latamore
80 Microcomputing Staff*

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"These market experts see the business microcomputer as still in its infancy."

He advocated programs with the flexibility to adapt to variations in business activities. For instance, he said, Radio Shack has a program which creates a matrix to hold data, programs, etc., that the user chooses to enter. In his report he predicts business software will generate only \$8,192,000,000

in gross sales in this decade.

In general, these market experts see the business microcomputer as still in its infancy. Eventually it will gain an important place in business. The questions that remain to be answered are how quickly this will happen and just what their place will be. ■

One of the biggest headaches in retailing is inventory. It must be performed continuously or you may find yourself in the embarrassing and costly position of running out of your most popular items. But keeping a running inventory up to date can involve hours of work daily. Even at that you will make mistakes and have problems; no system is perfect.

This was exactly the situation at Bond Discount Wine & Liquor in New York, where for 25 years two generations of the Schneider family have labored, devoting three man-hours a day to maintaining a perpetual inventory.

Enter the TRS-80.

"One day my father read about them in *The Wall Street Journal*," Paul Schneider said. "He went right out and bought one." He wanted a machine to do his inventory. What he ended up with was that and more.

For a start it replaced the cash register. When a sale is "rung up," it automatically adds the tax. It keeps complete unit pricing information on all items in the store. If the customer could get a better buy from a different size of the item he selected, the computer shows this on its screen where the customer can see it.

Bond was the first liquor store in New York state to offer unit pricing. The story was carried on two New York television stations.

The micro adds the dollar amounts from each sale to the appropriate bookkeeping categories—it can accept 15—thereby taking care of another major problem, the daily bookkeeping postings.

At the same time, the machine deducts each item purchased from two lists: one a record of what is out on the shelves, and the other a total inventory. The computer can list any items which have fallen below a predetermined minimum on the shelves so the stock boy will know what to bring up from the basement.

It will also list any items which have fallen below a predetermined minimum in total inventory and should be reordered.

Using a TRS-80 Model I with two disk drives, the system can handle 2,500 separate stock items, with minimums set sepa-



ately for each one, Schneider said. However, double-density disk drives would increase the system's capacity to 5,000—10,000 items.

The system goes another step, Schneider said. It keeps records of the total monthly sales of each item for the last 15 months. It then uses this information to calculate trends and seasonal fluctuations to project sales on each item for the next three months.

This item, alone, has saved Bond several times the cost of the system and the professionally written program, Schneider said, because it virtually eliminates costly over and under-stocking situations.

Schneider said the system is simple to use and requires no training. In fact, he said, on Christmas Eve, which is the busiest day of the year for package stores, his wife, who has no previous experience with micros, came in and ran the checkout all day with no problems.

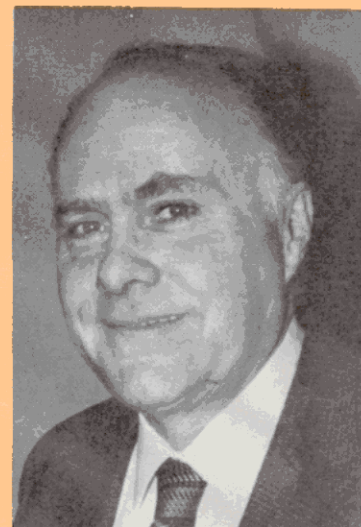
Schneider said he finds the microcomputer totally adequate.

"It's a matter of making the machine do what you want it to do," he said.

Schneider is selling his program which, he said, will run on either a Model I or Model III. It is available through Accurate Business Computers, 800 Preston Road, East Meadow, NY, 11554. ■

by Bert Latamore
80 Microcomputing Staff

**"I'm Wayne Green
and I can save you \$986
on the purchase of a
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I hope that has your attention."

"That's the difference between walking into your local Radio Shack store and plunking down hard cash . . . and buying from the ads in **80 Microcomputing** magazine. That's the difference for a simple combination such as a Model III two disk system with 48K of memory, a modem and a Line Printer II: The Radio Shack price for that combination is \$3,612. If you buy from the ads in my magazine, you'll buy exactly the same system for \$2,626.

So why throw away \$986?

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"Another is that it is the major source of information on the TRS-80 computer. In 1980 there were 335 feature articles on the system . . . with detailed instruction on how to do things (sorry about that), evalua-

tions of accessories and software . . . and so on. I guarantee you'll find the magazine invaluable.

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Wayne Green
Editor/Publisher



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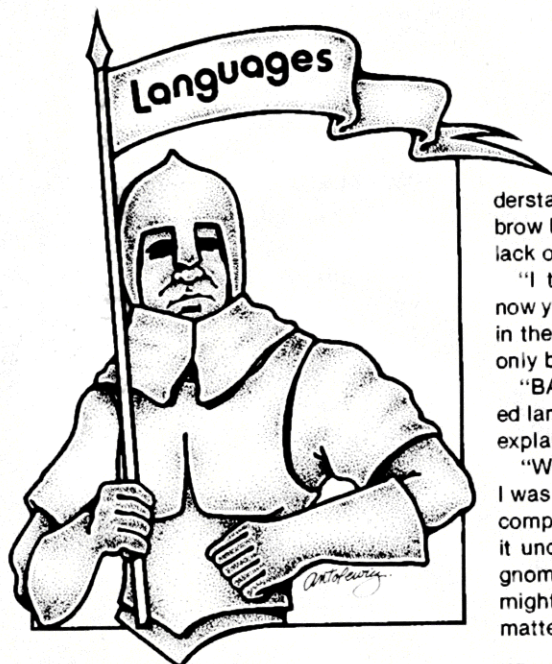
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317B8

In search of the pathway to computer enlightenment.

Language Quest '81



by G. Michael Vose
80 Microcomputing Staff

I knew that I would have to join the twentieth century sooner or later. Besides, I'm a college graduate and I can even handle myself in a disco. So I went down to the local computer store and started to browse. I sat down at a computer and typed HELLO on its keyboard and pressed this big white button. The screen showed ?SN ERROR and I figured I must have committed some kind of mortal sin. I was just about to try to sneak out the door when a salesperson in a snappy three-piece suit came up and asked if he could help me. I told him I had tried to talk to the computer but that things were not going well.

"That's because the computer only un-

derstands BASIC," he explained and my brow began to furrow in the early stages of lack of comprehension.

"I thought computers were brainy and now you tell me to stick to basics?" The guy in the three-piece suit gave me what could only be described as a tolerant smile.

"BASIC is a high-level, procedure-oriented language like FORTRAN or COBOL," he explained further.

"Wait a minute," I retorted. "Do I look like I was born yesterday? First you tell me the computer needs BASIC and now you claim it understands the language of a German gnome called a kobold." I began to think I might need to look more deeply into this matter of communicating with computers.

What Is a Computer Language?

My search to discover a way to communicate with the computer led me to some fascinating discoveries. First I learned that a computer language is simply a set of rules, representations and conventions used to transmit and convey information. Computer languages are classified as low-level or high-level. But low-level does not necessarily mean simple or easy.

As it turns out, the computer actually understands one and only one language. That language is called machine language. Machine language is a low-level language simply because it is at the level at which the computer can directly recognize and manipulate numbers. All other languages must be converted into machine language to be understood by the computer.

Computers can only understand numbers represented by groups of 1s and 0s called binary digits. Groups of these digits are called a binary code. Machine language is essentially binary code modified to allow you to enter and manipulate numbers using the more standard numeric form of decimal, octal or hexadecimal notation. A number in machine language will stand for a specific instruction (or memory address) that the computer can recognize and execute. This number is determined by the electronic architecture, or design, of the microprocessor. In other words, the machine was built to handle these numbers in a certain way. This process is accomplished using electronic devices, often called gates, which can only be opened or closed. These two states can represent a one or a zero, the digits of binary code.

One step up from machine language is assembly language. This language is also a low-level language and differs from machine language only in its code. Assembly language allows you to substitute certain mnemonics for numbers. Since these mnemonics are not directly recognizable by the

COMPILED	INTERPRETED
COBOL	BASIC
FORTRAN	PILOT
ALGOL	LOGO

Table 1

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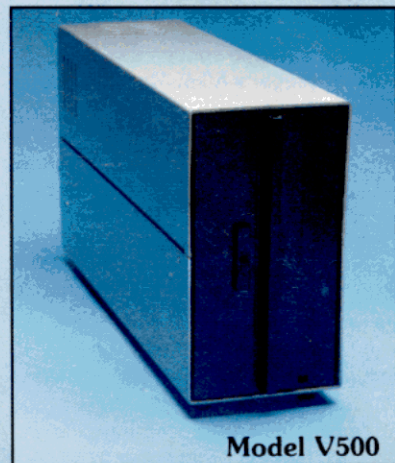
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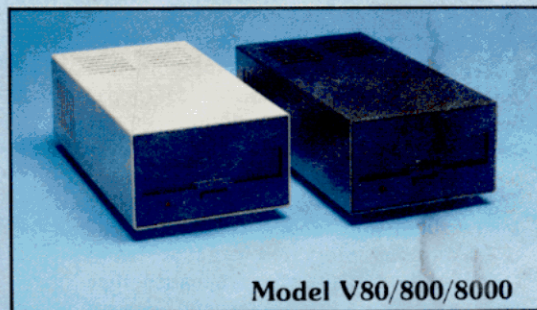
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Model V80/800/8000

"The question may have occurred to you, 'which language is the best one?'"

computer, they must be translated by an assembler. An assembler is a program that takes these non-machine language instructions and converts them into the numeric code understood by the computer.

Pseudo-Language For the Human Pseudo-Brain

Since low-level does not necessarily mean simple or easy when you are talking about computer languages, I assumed that a language called BASIC must be a low-level language. As is often the case when one makes assumptions, this turned out to be wrong. BASIC is a high-level language.

High-level languages can be understood more readily by you and I. They are symbolic languages which use recognizable English words, groups of numbers, special words and standard mathematical notation. It is important to remember that these alphanumeric symbols are *not* the internal language of the computer. The symbolic code of high-level languages must be either compiled, or converted, into machine language, or interpreted for the computer by a separate component called an interpreter.

There are several major differences between compiled and interpreted languages. Operationally, the difference between compiling and interpreting a source language is substantial. Each technique requires a separate component, either a compiler or an interpreter.

A compiler is a program that converts source language code symbols into executable machine language code. This is done after the program has been written, or coded, by the programmer. The compiled program can then be run. This process is analogous to that of a book being translated from French to English.

An interpreter is a component of the computer's permanent memory that actually interprets each character of source language code for the computer's brain (the microprocessor) as the program is being run. This process is analogous to the speech translators at the United Nations who translate words as they are being spoken.

Compiled and interpreted programs each have their advantages and disadvantages:

- Compiled programs cannot be executed until they are compiled, therefore they cannot be tested until they are written and converted. This compilation can often take a substantial amount of time.

- Compiled programs execute faster than interpreted programs because they eliminate the interpretive step and because they are, once compiled, machine lan-

guage.

- Interpreted programs are interactive. This means that the programmer can experiment with different commands and instructions and discover almost immediately if that command or instruction will work. This is because the command can be executed immediately, without having to be compiled.

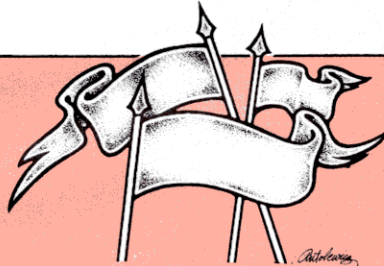
Some examples of compiled and interpreted languages are shown in Table 1.

Problems, Procedures— Procedures, Problems

The language picture was beginning to get a little clearer when I ran into yet another classification. This time I discovered that languages are further classified

as either problem-oriented languages, or procedure-oriented languages. These are pretty fancy-sounding categories, but they simply mean that languages are designed to allow us to solve specific classes of problems, or wide classes of problems. In the latter case, we have to develop a procedure to solve our problem.

Problem-oriented languages are designed to solve a specific class of problems. For example, the language whose acronym is ICES (Integrated Civil Engineering System) is designed to solve specific problems in civil engineering. The engineer has only to input certain types of data and the program computes the specifics for building a solid concrete wall. The engineer cannot use the program to balance his



Language Primer for the Novice

Compiler—A computer program that produces a machine language program from a source program that is usually written in a high-level language by a computer user. The compiler is capable of replacing single source program statements with a series of machine language instructions or with a subroutine.

Compile—To prepare a machine language program (or a program expressed in symbolic coding) from a program written in another high-level programming language, such as FORTRAN, PL/1 or COBOL.

Metacompiler—A compiler for a language that is used primarily for writing compilers, usually syntax-oriented compilers. A special purpose metacompiler language is not very useful for writing general programs.

Compiler Language—A source language that uses a compiler to translate the language statements into an object language.

ALGOL—An acronym for ALGOrithmic Language, an international high-level programming language designed for scientific programming. ALGOL is used primarily in Europe.

APL—A mathematically-structured lan-

guage developed by IBM Corporation. In its simplest mode, APL performs the functions of an intelligent calculator. The power of the language is demonstrated by its extended single operators which allow a user to directly perform such things as taking the inverse of a matrix, or solving a set of linear equations. APL is a powerful tool for the scientist or engineer.

Assembly Language—A programming language which allows a computer user to write a program using mnemonics instead of numeric instructions. It is a low-level symbolic programming language which closely resembles machine code language.

Assembler—A computer program that takes non-machine language instructions prepared by a computer user and converts them into a form (binary) that may be used by the computer.

ATOLL—A special language used by NASA on the Apollo space missions.

BASIC—Beginner's All-purpose Symbolic Instruction Code.

COBOL—COMMON Business Oriented Language. Every COBOL source program has four divisions, whose names and functions are: Identification division, which identifies the source program and the output of a compilation; environment division, which specifies those aspects of a data processing problem that are dependent upon the physical characteristics of a particular computer; data division, which describes the data the object program as output; and procedure division, which specifies the procedures to be per-

"The answer to that question will differ depending on who you ask."

checkbook. At the same time, the engineer does not have to know anything about programming to obtain the results he needs. The procedures for solving his problem are built into the program language.

Other problem-oriented languages include APT, RPG, COGO, GPSS, STRESS and others. One specialized group of problem-oriented languages is the list-processing group which includes LISP and SNOBOL. These languages are designed specifically to process non-numeric data, such as lists of names and addresses.

Procedure-oriented languages are more versatile. They allow the programmer to write routines to solve any problem that he can define and subsequently devise a solution for. FORTRAN is the grandfather of this

class of languages and is still one of the most powerful of the procedure-oriented languages. Designed to perform mathematical, scientific and engineering computations, FORTRAN exists today in five or six versions. Other procedure-oriented languages include COBOL, BASIC, Pascal and PL/1.

Will We Ever Use English?

The question may have occurred to you, "Which language is the best one?" The answer to that question will differ depending on who you ask. Programmers and manufacturers will argue, with merit, that one language is better than another. There can be different versions of the same language, very often to accommodate the unique design

of a particular manufacturer's machine.

To some degree, determination of the best language will depend on what application is planned. There probably shouldn't be one universal computer language in much the same way that there probably shouldn't be one universal automobile manufacturer. No one group can satisfy the needs of a large population.

One thing can be said with certainty. While the English language is too complex to adapt for use as a computer language, there will be other languages developed. Many will be simple, user-oriented languages while others will be used to solve specific problems. All will allow us to communicate more effectively with this powerful machine called the computer. ■

formed by the object program by means of English-like statements.

COGO—COordinate GeOmetry, a language used by engineers.

Cross Compiling/Assembling—A technique where one uses a minicomputer, large-scale computer, or time-sharing service to write and debug programs for subsequent use on microcomputers.

DDL—Data Description Language, a language for declaring data structures in a data base.

Firmware—Software that is hard-wired into a computer, usually as read-only memory (ROM). Changes can only be made by changing the chips.

FORTRAN—FORmula TRANslator, a high-level programming language used to perform mathematical, scientific and engineering computations. There are two versions, FORTRAN and Basic FORTRAN.

High-Level Language—A programming language oriented toward the problem to be solved or the procedures to be used.

Interpreter—A computer program that translates each source language statement into a sequence of machine instructions and then executes these instructions before translating the next source language statement.

JOVIAL—Jules' Own Version of the International Algorithmic Language, a scientific language used by the U.S. Air Force.

Language—A set of rules, representations, and conventions used to convey information.

LOGO—A language suited to and used by

grammar and junior high students. Developed at MIT by Seymour Papert and staff.

Low-Level Language—A machine-dependent programming language translated by an assembler into instructions and data formats for a given machine. Same as assembly language.

Machine Code—An operation code that a machine is designed to recognize.

Machine Instruction—An instruction that a computer can directly recognize and execute.

Machine Language—The basic language of a computer. Programs written in machine language require no further interpretation by the computer.

Metalanguage—A language which is used to describe a language.

Mnemonic—Pertaining to a technique used to aid human memory. A word or name which is easy to remember.

Mnemonic Code—An easy-to-remember assembly language code, for example, a code that uses an abbreviation such as MPY for multiply.

Native Language—A language peculiar to the machines of one manufacturer.

Object Code—Output from a compiler or assembler which is itself executable machine code or is suitable for processing to produce executable machine code.

PL/1—A high-level programming language designed to process both scientific and business applications. It contains many of the best features of FORTRAN, COBOL, ALGOL and other languages as well as a number of facilities not available in previous languages.

Problem-Oriented Language—A high-level, machine-independent programming language designed for the convenient expression of procedures used in the solution of a wide class of problems, e.g., FORTRAN, COBOL, PL/1, etc.

Programming Language—A language used to express computer programs.

Symbolic Language—A pseudolanguage made up of letters, characters and numbers which are *not* the internal language of the computer system.

RPG—Report Program Generator, a popular business-oriented programming language. The language will allow the user to program many business operations as well as generate reports. A fairly simple RPG program can perform a rather sophisticated business task. It is relatively easy to learn.

SNOBOL—StriNg Oriented SymBOlic Language, a string manipulation programming language used primarily in language translation, program compilation and combinatorial problems. The language stresses the ability to manipulate symbolic rather than numeric data.

Source Program—A computer program written in a source language such as BASIC, COBOL, etc. It is converted to the machine code object program by a special processing program, a compiler, interpreter or assembler.

Syntax—The grammatical and structural rules of a language. All assembly and high-level programming languages possess a formal syntax.

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*Here's how to optimize BASIC
and magnify computing power by calling in a Macro.*

A Macro Processor For BASIC—Part I

The opening segment of this article, the first of a series, is part of a letter that accompanied Alan Olmstead's manuscript to our offices. The editors felt that his thoughts were sufficiently perceptive to preface his article, particularly in our examination of languages.—Eds.

To perceive the microcomputer as a kind of calculator with delusions of grandeur is to miss the central point of its potential for changing the way mankind lives. The microcomputer is the first form of artificial intelligence applied on a large scale to hundreds of thousands of individuals. Furthermore, it has been applied under conditions of virtual natural selection—only those people capable of realizing what it is come forward to acquire one.

As demonstrated so admirably in the lifetime work of J. J. Bachoffen during the last century, intelligence—natural or artificial—is inconceivable without language, if a measure of intelligence is the ability to classify real things into abstract, invented categories. Thus, the importance of the microcomputer will not be found in mathematical applications, but in linguistic ones. Aside from theoretical and technical applications, there is essentially little need for improving the microcomputer's capacity for solving computational problems. But in terms of the existence and use of language—and its corollary, intelligence—we are little more than infants.

The only computer languages available to us are dinosaurian manifestations of essentially electrical, not electronic, logic. These ponderous beasts all function according to the elementary formula "this input equals that output." A specific and limited command repertoire is first recognized, then equated to a modestly variable form of output. If the repertoire lacks an exactly appropriate command syntax, we must have an alternative, leaving the compiled language entirely and switching into an assembly language subroutine.

The reason for such a limited concept of language (I would go so far as to question that they are even languages) is not lack of creativity. The languages serve the needs of their developers, and their developers are interested primarily in selling computer hardware. Thus, we saw Radio Shack introduce the Model II before correcting the built-in deficiencies of the Model II, and IBM deliberately sabotaging the Model 5110 to keep it out of the System 34 marketplace. As long as language remains in the private domain of large corporations the microcomputer customer will continue in his role as the ex-

pedient servant of next year's fiscal planning.

As the translation of the Bible contributed to the splintering of the Church of Rome when its promulgation was intended to preserve unity, so the rigid structure of predetermined languages must prove eventually counterproductive. Application needs change, and those languages which do not keep pace will doom the machines on which they run. So-called "dead" languages die because they no longer serve a purpose. Alternatively, newly evolved languages remain alive through their continuous use. The language of artificial intelligence must be capable of doing likewise. Like a beautiful bird, language must be set free before it will sing its best. language must be set free before it will sing its best.

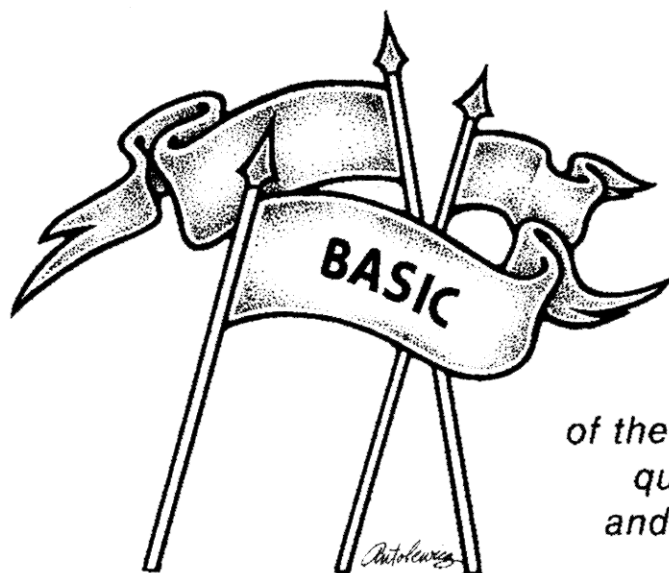
Language consists of two parts, form and content. The form, its parts of speech—nouns, verbs, prepositions, etc.—has remained nearly unchanged for centuries. But the content of language, the actual words and their meanings, change continuously through time, so rapidly, in fact, that it is commonplace for parents to complain that they do not understand their children.

Achieving such independence for the individual user is the whole point of MetaBASIC. It is not merely a simpler method of moving from a high level language like BASIC into assembled code, or even merely to expand the existing command repertoire. It is rather to give the user the actual ability to make up his own command words and sentences according to his needs—even if he is the only user in the world with such a need. I have provided a general repertoire of MetaBASIC command sentences to serve very common needs, such as:

```
LOAD STR A$(FROM) B$
PLOT FROM(X1,Y1) TO(X2,Y2) WIDTH(W)
```

However, these command sentences are merely electronic baby-talk. It is my sincere hope that users will invent their own command sentences with such enthusiasm that in a matter of a few years even I, the originator, will not recognize the language. Best of all, they will do so governed only by their own needs and desires, without having to ask my permission or obtain my cooperation in the effort.

Just as we cannot foretell the style of the next major poet or novelist, none of us is capable of imagining what will become of this industry when 50,000 intelligent young people are turned loose to build anything they are capable of imagining. ■



"BASIC might be called the guitar of the rock 'n' roll computer set, because it is quite willing to respond with good results and requires... only modest talent to use."

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High-level applications programmers of the sixties and seventies were individual members of large teams which were backed up by small battalions of assembly language specialists. Individual high-level programmers concentrated on developing applications, while assembly language teams concentrated on optimizing the whole computer system. When an application method became too expensive for these individual high-level programmers, the team developed new tools to ease their burden. These tools are brought into operation within the application programs by means of Call commands.

Contemporary BASIC programmers are one-person computer departments. Even among the small percentage which are able to program in assembly language, who has the time? Assembly language programming requires ten times more programming hours than BASIC. The BASIC programmer is committed only to accomplishing his tasks using BASIC—aside from the few utilities which appear on the market from time to time. Yet the programmer's demand is for ever more speed.

The first part of this series will emphasize new tools and techniques for optimizing BASIC beginning with the BASIC macro processor.

What is a Macro?

The definition of a macro varies from manufacturer to manufacturer, but for our purposes, the following definitions will suffice:

- A macro is a program module of varying size, which cannot execute by itself for two reasons: It is incomplete, being written to perform a specific kind of task; and it contains specialization commands which, when acted upon, change the form of the macro into a specific kind of sub-module which can then be executed.
- A macro is always in source language which resides in a separate library file from any given application program into which it will later be incorporated.

● A macro is capable of including, omitting and changing the form of its source code based upon the instructions received from the applications programmer at the time of the macro call.

● A macro is called into the user's program during the program writing phase, before interpretation, compilation or assembly.

The macro processor is an interpreter program that calls the macro from its library into the new applications module, shaping it according to the user's instructions contained in the macro call command syntax (see Fig. 1).

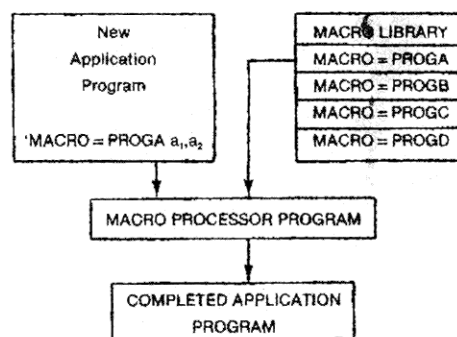


Fig. 1.

At the end of 1980, the microcomputer industry came to an early maturity in many areas of its development. Witness the emergence of BASIC as the most common programming language in the world. BASIC was clearly designed with straightforward syntax in mind by which computer novices might understand the workings of a computer in a short period of time. In this regard, the language is a total success, as there never was an easier language to learn and use.

BASIC might be called the guitar of the rock 'n' roll computer set, because it is quite willing to respond with good results and requires practically no formal education and only modest talent to use. But in truth, BASIC is an astonishingly wasteful language which, in some environments, simply cannot be used.

Because of certain applications like communications (600 baud is the practical limit under interpreted BASIC) and business problems involving reiterative mathematical treatments, the BASIC cross-compiler emerged. The cross-compiler was touted as the cure of BASIC's ills as a run-time device. However, the greatest deficiency among compilers is their uniform failure to recognize that BASIC, as it is used, is a totally different language from its high-level predecessors, such as COBOL and FORTRAN. Because of this difference, it requires additional features.

The specialization of a called macro takes place when two programming elements interact in the macro processor program. First, there are arguments, or parameters as they are sometimes called, appended to the end of the macro Call command. Second, there are various tests coded directly into the lines of BASIC within the macro library module (In this case, PROGA) which tell the macro processor what to do if the call arguments are: present, absent, relational to a given integer value, or in AND/OR relationships between two of the arguments.

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*"The macro processor
is an interpreter program
that calls the macro from its library
into the new applications module."*

To more clearly illustrate this, examine the generalized code illustrated in Example 1. It appears to be BASIC code, but it cannot be executed either in interpreter or compiler form. At line 1000, a remark line, appears the pseudo-command word 'MACRO =', which signals to the macro library processor that a library module is being defined. The definition continues until an 'ENDMAC' pseudo-command word is encountered (at line 1100). The name of the library module follows the pseudo-command. It does not use any form of a BASIC reserved word, which might present a problem to some interpreters and compilers, even though it appears inside a comment line.

Finally, a series of arguments appear, each separated by a comma. The arguments are not legal BASIC values, but are two numbers preceded by the flag symbol &&.

The arguments could continue up to ninety-nine—from 01 to 99. Argument 00 is used

by the library processor as internal work space. The arguments are in ascending order only for convenience. The same is true of sequence, which may contain skips or gaps in which argument numbers are used. Line 1000 indicates to the library processor the outer dimensions of the specialization problem about to be undertaken.

Throughout the macro appearing in Example 1, there are true BASIC statements, such as line 1010, and other almost-BASIC statements, like line 1020. Line 1020 is a standard Radio Shack TRSDOS Open command, but in generalized form. It will be specialized into a true command when the user presents the actual values of arguments one, two and three to the library processor program. During specialization, the true arguments presented to the library processor are substituted into their physical counterpart locations (one into one, two into two, etc.), and the resulting BASIC code is then included into the user's program in its

```
1000 'MACRO = DSKOPN &&01,&&02,&&03,&&04,&&05,&&06
1010 ON ERROR GOTO 1050
1020 OPEN &&01,&&02,&&03
1030 ON ERROR GOTO &&04
1040 RETURN
1050 ON ERROR GOTO &&04
1060 'BOOL &&05 + &&06
1070 &&05 = &&06
1080 'ENDB
1090 GOTO 1040
1100 'ENDMAC
```

Example 1. Example of a Type of Generalized Code

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```
100 'PROGRAM MODULE "TESTPROG"
110 CLS: CLEAR1000: DIM A$,B$,C$: ON ERROR GOTO 260
120 INPUT "ENTER DISK FILE NAME: ";A$
130 INPUT "ENTER DRIVE NUMBER: ";B$
140 A$ = A$ + ":" + B$
150 B$ = "R": C$ = " "
160 GOSUB 220: IF C$ = " " THEN 170 ELSE 240
170 FIELD1,64 AS X1$,64 AS X2$,64 AS X3$,64 AS X4$
180 GET1,1
190 PRINT X1$:X2$:X3$:X4$
200 CLOSE1
210 END
220 'MACRO = DSKOPN B$,1,A$
230 "260,C$,"CAN'T OPEN FILE "
240 PRINT C$:A$
250 GOTO 200
260 PRINT "ERROR ";ERR;" AT LINE ";ERL
270 STOP
```

Example 2. User's Program Before Specialization

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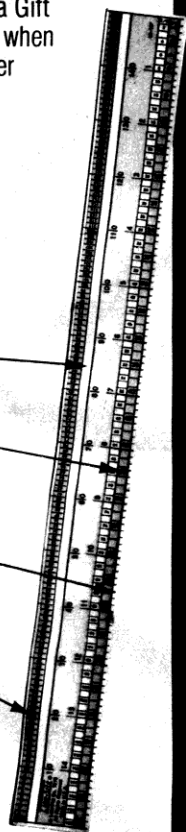
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*"Anything and everything
appearing between two commas
will be considered to be the value of the argument,
including both single and double quotes."*

new, interpretable/compilable form.

The programmer's new program gives the
specialization commands to the library pro-
cessor program. Example 2 shows a pro-
gram, which opens up a named file and
prints the first record on the screen. Begin-
ning at line 220, and including line 230, the
sample macro illustrated in Example 1 is
called by the pseudo-command 'MACRO =',
in the exact same form as previously seen.
This time, however, instead of following the
pseudo-command with dummy arguments,
the actual proper values are given. The
proper values must be in ascending sequen-
tial order, and if any arguments are option-
ally omitted, the parameter slot must be
preserved. This is done by inserting the
comma which would have followed the ar-
gument if it were present.

Lengthy Arguments

In the case where the arguments are too
lengthy to fit on a single line, they may be
continued in sequence to the next line with
the continuation pseudo-command word '-'.
(See line 230 in Example 1.) Of further inter-
est is the delimiter character comma. Any-
thing and everything appearing between
two commas will be considered to be the
value of the argument, including both single
and double quotes. However, the one value
which may not appear between two com-
mas is another comma.

Note also that the dummy argument
&&01 (and others) require only four charac-
ter positions, while literal arguments (with
actual proper values) that are substituted
into that place may take either fewer or
more character positions. This is of no con-
sequence; the specialized output code will
be expanded within the same line, not to ex-
ceed a total of 128 character positions.

The reason why the dummy argument is
required to take four positions, even if the
leading zero must be inserted (&&01), is for
flexibility. For example, if the generalized
code directed the last two numbers of the
lines to be used as a GOTO, it would look
as follows:

```
1000 ON &&01 GOTO &&0210,&&0220,&&0230
```

When specialized, this line will test the val-
ue of the numeric variable specified as
argument one and conditionally jump to
one of three lines whose numbers are rela-
tive to a base line number like 5000. The de-
sired specialization would be:

If the leading zero were not present in &&02,
the library processor would either look for
&&21, &&22, &&23 or for &&210, &&220,
&&230, the latter group being, of course,
illegal.

In line 1060 of the generalized code in Ex-
ample 1, there is another pseudo-command
word, 'BOOL', which is logically grouped
with the pseudo-command word 'ENDB' at
line 1080. This pseudo-command set incor-
porates elementary Boolean logic in a
method by which the library processor de-
cides whether or not certain lines or sets of
lines are supposed to be included into the
specialized output. The Boolean method
tests for truth. Accordingly, line 1060 is in-
terpreted to mean "If *both* argument five
and argument six were specified in the spe-
cialization pseudo-command line, then *do*
include all lines until the next 'ENDB line is
found." If either argument five or six had
been optionally omitted by the calling pro-
grammer, line 1070 would not appear in the
specialized output.

*"The Boolean method
tests for truth."*

The forms of the 'BOOL pseudo-com-
mand permit quite complicated and flexible
condition testing. The OR combination is in-
dicated by a minus sign between two argu-
ments:

```
'BOOL &&23-&&03
```

This means "If argument 23 *or* argument 3
is present, *include* the lines which follow
until the next 'ENDB pseudo-command." Re-
member that the 'BOOL command is al-
ways a test of truth for inclusion.

In addition to the logical AND and OR
possibilities, combinations of present and
absent argument conditions may be tested
in the 'BOOLEan test for inclusion. The ex-
amples of the arguments illustrated so far
have actually implied a "+" just before the
numerals of the argument. For example, the
illustration above actually means && + 23—
&& + 03, that is, a test for the *presence* of
argument numbers 23 or three. A test for ab-
sence could be written:

```
'BOOL && - 23 - && + 03  
'BOOL && - 23 + && - 03
```

```
1000 ON A GOTO 5010,5020,5030
```



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"It's important to write BASIC functions with the same deliberate and meticulous care as when writing assembly language."

In the first example, inclusion will occur if argument 23 is absent, or, if argument three is present. In the second example, inclusion will occur if argument 23 is absent, and if argument three is absent. The OR condition could as easily test for the absence of either argument:

```
'BOOL && - 23 - && - 03.
```

In order to obtain additional complexity and flexibility, nest combinations of code lines to 10 levels of 'BOOL. The rules applying to subroutines also apply to nesting.

The code lines appearing in Example 3 illustrate the results of running the user's program (Example 2) against the macro library through the macro processor program. A number of quite interesting things did and did not take place.

First, note that only the named macro, DSKOPN, is included into the user's final program. Other macros cataloged in the same library file with DSKOPN are not called.

Second, the macro is inserted into the user's calling program in the exact sequential place where its pseudo-command occurred. Thus, it is the programmer's responsibility to document this macro library, knowing which modules may be dropped through and which must be accessed by the GOSUB command. The macro processor program makes no attempt to analyze program logic

(except for common macros, described below).

Third, all arguments are inserted into their corresponding argument locations. The format of each line is expanded or shortened, accordingly.

Fourth, since both arguments five and six are specified, line 1070 of the original macro is included, as line 280 of the final, specialized output. Both the 'BOOL and 'ENDB pseudo-command lines are not included, nor the 'ENDMAC.

Fifth, the entire program is renumbered.

Additional Features

This simple example illustrates the tremendous increase in programming power a macro processor makes possible. It's important to write BASIC functions with the same deliberate and meticulous care as when writing assembly language. Such authorship is expensive in programming time and, therefore, should be placed in a macro library for economical reuse.

Since economy is the principal purpose of the macro processor, there are two additional devices which conserve both memory and time. These include the common module designator and the list-printing control commands.

A common macro module's call is common to several sections of the user's program, or is called through a nested macro by two or more macros. A good example of this might be a disk I/O command which, for

economy of space, serves several different logically designated files. The macro appears in the library as:

```
1000 'MACRO = DSEQP &&01,&&02
1010 PUT&&01,&&02
1020 RETURN
1030 'ENDMAC
```

This macro is a simple Put to a sequential disk file. Arguments one and two are, respectively, the logical file number and the record number. But the arguments could be specified as the numeric variable containing the logical file number, and the numeric variable containing the record number. In that event, the macro name could read:

```
1000 'MACRO = DSEQP-C &&01,&&02
```

The macro would then be declared common to any and all places in the program where the same macro call is found. The first form of the macro would appear every time it is named in the user's program or is nested within any other macros called by the user's program. But the second, common form would appear in the user's program only once, no matter how many times it is called.

The common designation -C causes the macro processor to search through the macro for the Return command. If it is found, any subsequent call to the common macro will be replaced by the GOSUB nnnn command. If no Return command is found, every subsequent call to the common macro is replaced by the GOTO nnnn command.

The argument values that specialize a common macro are taken from the first macro call encountered (lowest line number). The argument values specified in subsequent calls are completely ignored. However, it is a good idea to include them each time because it is easy to go back and insert a new macro call. It is also easy to forget that it nests a call to a common macro whose specialization arguments are now in the second encountered macro call.

This warning also points up another feature of the macro processor's 'BOOL logic: the present/absent switch operates within every line, even if there is no 'BOOL pseudo-command. If a line of macro code calls for an argument, and if that argument is not provided with the macro call, the dummy argument &&nn remains in the line and an error message is printed at the left of the line during the final printing.

The second economical feature permits

```
100 'PROGRAM MODULE "TESTPROG"
110 CLS: CLEAR1000: DIM A$,B$,C$: ON ERROR GOTO 320
120 INPUT "ENTER DISK FILE NAME: ";A$
130 INPUT "ENTER DRIVE NUMBER: ";B$
140 A$ = A$ + ":" + B$
150 B$ = "R": C$ = ""
160 GOSUB 220: IF C$ = "" THEN 170 ELSE 300
170 FIELD1,64 AS X1$,64 AS X2$,64 AS X3$,64 AS X4$
180 GET1,1
190 PRINT X1$,X2$,X3$,X4$
200 CLOSE1
210 END
220 'MACRO = DSKOPN B$,1,A$,320,C$,"CAN'T OPEN FILE "
230 ON ERROR GOTO 270
240 OPEN B$,1,A$
250 ON ERROR GOTO 320
260 RETURN
270 ON ERROR GOTO 320
280 C$ = "CAN'T OPEN FILE "
290 GOTO 260
300 PRINT C$,A$
310 GOTO 200
320 PRINT "ERROR ";ERR;" AT LINE ";ERL
330 STOP
```

Example 3. User's Program After Specialization

"Often, the (program) writer calls as many as 30 or more macros in each BASIC program, none of which is being seen for the first time."

selective control over printed listings. After the macro library modules are debugged and used several times, the user has no interest in seeing them again. Furthermore, with practice in writing macros, the user finds ways to standardize his programming procedures, so that the macro modules in the library become large and numerous. Often, the writer calls as many as 30 or more macros in each BASIC program, none of which is being seen for the first time.

Selective listing controls are illustrated in these two examples:

```
1000 'LIST#22-#255
1010 ....
1020 ....
1030 'LISTN
1040 'LIST#33 + #255
1050 ....
1060 ....
1070 'LISTN
```

At line 1000 (either in the user's program or in a macro), the list-off command states, "Do not print the following lines until the next list-on command, unless print suppression is overridden by operator's keyboard switches number 22 or 255." These switches are entered either at the beginning of the second pass (after macro specialization but before printing) by the operator, or they may be entered in the program itself by the pseudo-command:

```
1000 'SWITCH #22,#33,#255
```

(The commas are included only for readability, since the # is the controlling delimiter.)

The switch numbers mean anything the programmer wants. For example, switch 255, the highest available switch, might mean GLOBAL PRINT. When switch 255 is entered, every section of code containing the simple switch command #255 or the OR switch command #nnn-#255 would print.

Operating Requirements

Given the 256-byte character of nearly all disk systems, you should have 64K (48K user) main memory with two disk drives. The macro library and user application program are input to the macro processor from one drive. The specialized output file is written to this same drive. The other drive is reserved as working space for the macro processor program.

The macro library should not contain more than 160 macros, and a five-inch disk system should limit the number of argu-

ments per macro to 32. Macro nesting should also be limited to ten levels in such a small system. Visually illustrated, a 10-level macro call nest would appear:

```
1000 'MACRO = PROGA &&01,&&02,&&03
1010 'MACRO = PROGB &&...&&...
1020 'MACRO = PROGC &&...&&...
1030 'MACRO = PROGD &&...&&...
1040 'MACRO = PROGE &&...&&...
1050 'MACRO = PROGF &&...&&...
1060 'MACRO = PROGG &&...&&...
1070 'MACRO = PROGH &&...&&...
1080 'MACRO = PROGI &&...&&...
1090 'MACRO = PROGJ &&...&&...
1100 'CODING FROM PROGJ
1110 'ENDMAC
1120 'CODING FROM PROGI
1130 'ENDMAC
1140 'CODING FROM PROGH
1150 'ENDMAC
1160 'CODING FROM PROGG
1170 'ENDMAC
1180 'CODING FROM PROGF
1190 'ENDMAC
1200 'CODING FROM PROGE
1210 'ENDMAC
1220 'CODING FROM PROGD
1230 'ENDMAC
1240 'CODING FROM PROGC
1250 'ENDMAC
1260 'CODING FROM PROGB
1270 'ENDMAC
1280 'CODING FROM PROGA
1290 'ENDMAC
```

Program line lengths should be kept at or below 64 bytes, including the line numbering characters. However, this is not a restriction, since programming for macros usually involves so many 'BOOLEan operators that lines are short anyway.

The total number of lines per program should be kept at 2500 maximum, including all specialized macros. However, with longer lines it probably would not be possible to contain 2500 lines within the computer's user memory under the interpreter, and cross-compilation into executable machine language would definitely not be possible.

As indicated above, the macro processor operates in two passes. If any called macros have not been found in the named library, a second library may be named and two more passes result. This continues until all macro calls have been honored. If any called macro cannot be found when the operator calls for a print listing, they are flagged with an error indicator at the left of the line number. Error-flagging also overrides print suppression, in case one of the unfound macro calls is nested inside another macro.

Line number references are also important. The user program may reference any

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*"A line number which is
the name of a line
may not be a parameter."*

of its own lines, some of which are macro
calls. But the user may not reference any
line believed to be inside a macro or an un-
defined line error will be flagged.

When writing a macro library module,
lines within the macro may be numbered at
the convenience of the programmer—they
will never remain similarly numbered after
specialization. A macro may reference only
its own lines, unless the line number is sup-
plied as an argument to resolve a GOTO,
GOSUB, Then or Else command word in the
macro with one of the user's program lines.
An argument line number may not attempt
to reference a line number internal to an-
other macro.

A line number which is the name of a line
may not be a parameter. For example:

&&03 GOTO &&07

This line is illegal, because it does not begin
with a number. However, as described
above, the following is legal:

1000 GOTO &&07

The value for argument number seven is a
line in the user's program.

Any line number which is equal to or less
than the original (library file) line number of
a macro, but which is not supplied as an
argument value, is considered to be a Re-
start command.

For example:

```
1000 'MACRO = PROGA-C &&01,&&02,&&03
1020 PRINT@&&01,&&02:&&01 = &&01 + 64:&&03 =
    &&03 + 1
1030 ON &&03 GOTO 0,0,0,0,1040
1040 RETURN
1050 'ENDMAC
```

This macro provides repeated printing of a
message (from one to five times) depending
upon the value of the numeric constant
named as argument three. The zero line
numbers in line 1030 will be replaced with
line number 1000, as would be any number
from 0-999.

Conclusions

Although writing a macro processor is
not easy fare for any but experienced pro-
grammers, it can and should be written in
BASIC. If made a macro itself, the library
processor program may be specialized for
such diverse purposes as macro library pro-
cessing for COBOL and for word process-
ing applications, such as filling in pre-print-
ed forms and contracts.

Once debugged, it should be cross-com-
piled and run as executable machine code in
order to increase its speed (by as much as 30
times) in some of its math/logic functions. ■

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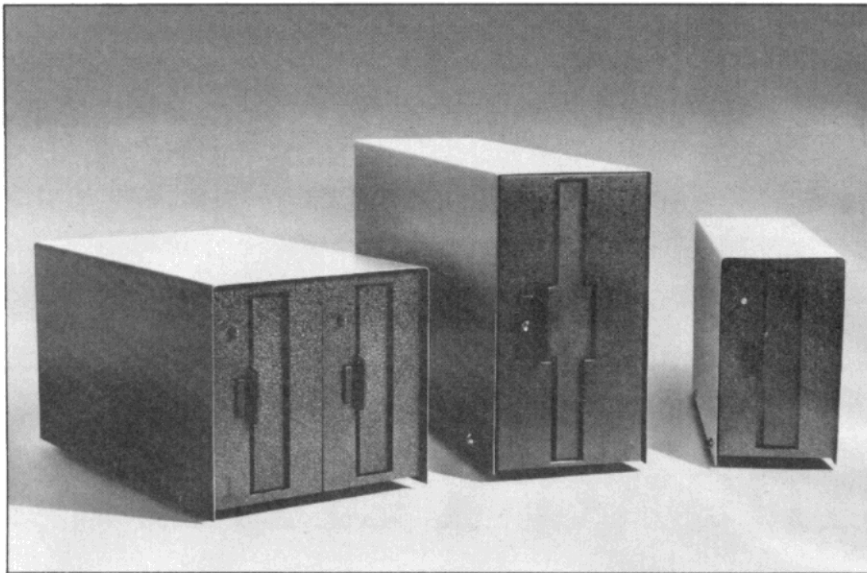


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Some buzzwords defined.

Coming to Terms

Joe D. Fugate
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The word *computer* is becoming a common buzzword. However, along with the microcomputer has come many not-so-common concepts that are both unfamiliar and confusing to the layman.

Let's lay some ground work: The TRS-80 (and all microcomputers) is based on a particular chip (integrated circuit) or microprocessor. The TRS-80 microprocessor chip is called the Z-80. To program the Z-80 directly, one must use numeric codes known as machine-code. This is not very convenient for humans who are not accustomed to talking to each other in strings of numeric codes.

To ease our communication problem, assemblers, compilers and interpreters were developed. The basic job of these three is the same: to decode your programs into something the machine can understand and operate on. How they each accomplish this is where the difference between them lies.

Your Level II or Level I ROM is a BASIC interpreter. That is, the ROM is coded to interpret the computer language known as BASIC. Another ROM might be designed to interpret FORTRAN, another Pascal.

Interpreter vs Compiler

Let's talk about the difference between your BASIC ROM and a BASIC compiler. The following are concise descriptions of the functions of an interpreter and a compiler:

Interpreter

1. Examines BASIC program statements.

2. Determines the action requested.
3. Calls machine code subroutine(s) that do the action.

Compiler

1. Examines BASIC program statements.
2. Generates equivalent machine codes.
3. Saves generated machine code.

A compiler generates a genuine machine code replacement for a BASIC program, while an interpreter only fakes it.

The outstanding feature of an interpreter is its ability to make the computer seem ready to do your every bidding—to be interactive. It immediately does what is requested. This nicety is not free, though; it costs in speed. For example, when you code a FOR-NEXT loop, an interpreter must re-interpret each instruction every single time it goes through the loop! To enhance the interactive feature, the interpreter is constantly scanning the keyboard (taking valuable time) so the computer will always remain ready to do your bidding.

With a compiler, getting from the program coding stage to the program running stage is less convenient, but what the compiler lacks in convenience, it makes up for in program execution speed. Compare the programming steps required with an interpreter versus that of a compiler:

Interpreter Programming Steps

1. Code program statement(s).
 2. Run program.
- (The program doesn't work the first time? Locate the offending statement and repeat the above steps until it does work.)

Compiler Programming Steps

1. Code program statement(s) (source).

2. Run statements through compiler to produce machine code output (object).
 3. Machine code program is saved on tape or disk.
 4. Save source program statements from step 1.
 5. Reload machine code program from tape or disk (step 3).
 6. Run machine code program.
- (The program doesn't work right? Uh-oh. You're going to have to reload the compiler program, reload your saved source code from step 4, and repeat all the steps to replace the offending statements. You must repeat this until the program works.)

Using a compiler seems like a lot of hassle, doesn't it? Ah, but the final result makes it all worth it! The machine code output from a compiler can be run directly, without the need for an interpreter standing between your BASIC program and the machine. As a result, compiled programs will typically run 10 to 20 times faster than the same source program running through an interpreter. Sure beats that 2X clock mod!

Assemblers

An assembler is similar to a compiler in function. The difference is that an assembler is used to make coding direct machine code a little easier for us humans. For example, to the TRS-80, 128 (hexadecimal 80) means "take the contents of the B register and add it to the A register." You have to have a really good memory to remember all 256 possible machine code instructions by their number codes! An assembler simply allows you to code "ADD A,B" and it will replace that mnemonic phrase with 128 when you run the assembler against your mnemonic machine code. See Figs. 1 and 2.

DIAGRAM OF INTERPRETER FUNCTION

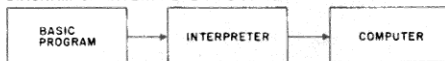


Fig. 1. The interpreter stands between your program and the computer. Your program simply tells the interpreter which machine code subroutine(s) to run to get the result you want.

DIAGRAM OF COMPILER OR ASSEMBLER STEPS

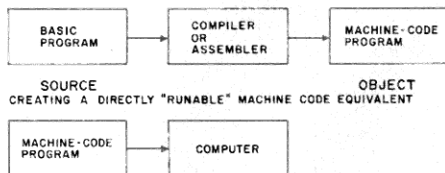


Fig. 2. In the compiler method, there is ultimately nothing standing between the computer and your program. As a result, execution is much faster. However, a compiler involves many more steps to get from the source program to the directly executable object machine code.

Subroutines and Macros

There are methods available to you as a programmer that will spare you the tedium of repetitive coding. The most commonly used is the subroutine. Compilers and assemblers also often incorporate an additional method—the macro.

Using subroutines, you code only a single copy of your repetitive code, and trigger its execution with a subroutine call (GOSUB in BASIC). At the end of your subroutine code you must return control back to your calling program (RETURN in BASIC). You need to code your subroutine only once, yet you can use it often. Subroutines reduce the over-all size of the program as well as provide relief for the programmer's poor numb fingers.

With all its virtues, a subroutine does cost time. When the computer is told to execute a subroutine, it takes time for the computer to figure out where the subroutine is, execute the subroutine, and then determine where to resume processing again. With some compilers or assemblers, there is an alternate approach to the subroutine: the macro.

The macro is best thought of as a kind of in-line subroutine. A macro inserts the subroutine code into your program each time it is used. Using a hypothetical programming language, let's illustrate how a macro is used.

This code tells the computer this is a macro routine.

```

ADDEMUP MACRO:
INPUT X
Y = X + Y
END MACRO
  
```

Before you run the compiler against your program, the following shows how you

might code ADDEMUP to sum three input numbers and display a total:

```

Y = 0
ADDEMUP
ADDEMUP
ADDEMUP
DISPLAY Y
STOP
  
```

When the compiler is run against your program, it will see ADDEMUP and replace ADDEMUP with the actual code it represents:

After compiler macro expansion:

```

Y = 0
ADDEMUP      *MACRO REPLACED*
INPUT X
Y = X + Y
ADDEMUP      *MACRO REPLACED*
INPUT X
Y = X + Y
ADDEMUP      *MACRO REPLACED*
INPUT X
Y = X + Y
DISPLAY Y
STOP
  
```

After macro expansion, the compiler will convert the expanded code into machine code.

With the compiled program loaded into the computer and run, the computer will never know we coded all those commands

with the help of a macro.

Why not always code a subroutine for repetitive code instead of a macro? After all, subroutines take less memory! Again, the reason goes back to the memory/run-time trade off. Even though a subroutine saves memory, it's slower. All those macro expansions for each use of the macro take memory, but save time!

Did you know when you compile a BASIC program, each BASIC statement could generate several equivalent machine code instructions? What does this mean? Your BASIC program statement is actually a *macro*! Ah-ha!

Link Editors and Loaders

A loader is a special loading program that will load your machine-code and move it around in memory. A link-editor is a fancy loader that will tie two or more programs with references to each other together into one big program.

The link-editor allows you to code your program in modules if you like (modular programming). You can code each module separately and then link-edit them together.

You should now understand these computer terms a bit better. At least, better than the fellow who typed this graffiti on a computer in a Radio Shack store: Byte My Baud. ■

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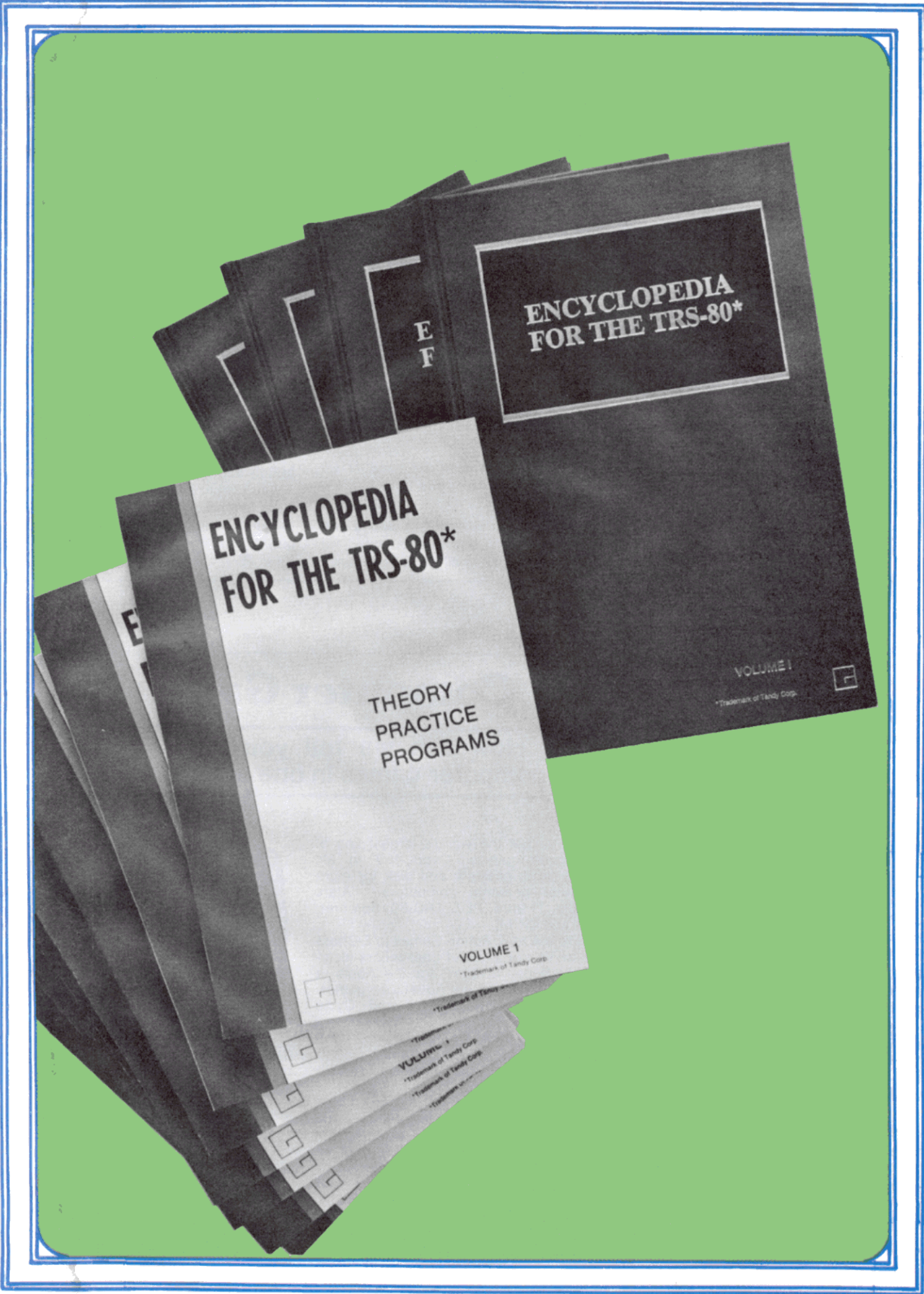
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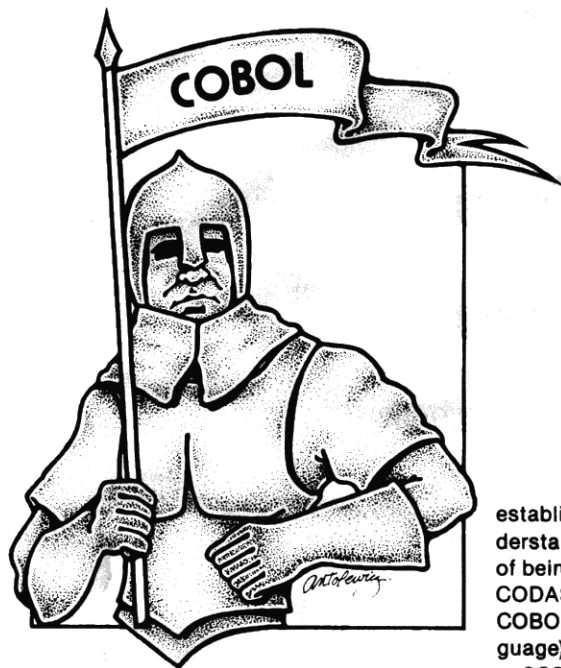
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Several languages are vying for primacy among microcomputer users. What we call BASIC is really a generic term for each manufacturer's version of an equation-oriented language. The diversity of BASIC precludes its consideration as a single entity. We need fewer, not more, languages.

The need for a minimum number of languages is apparent. If we are to communicate ideas effectively, we must have an understanding of the rules. The more languages there are, the greater the number of rules. Program portability becomes more difficult with the increasing number of languages. The more conversions required, the higher the probability of errors and misinterpretations.

Ideally, an industry committee should be formed to standardize a language, as did the Conference on Data Systems Language (CODASYL) more than 20 years ago, which

established an English-based language understandable to businessmen and capable of being easily changed. The language that CODASYL defined and developed was COBOL (Common Business Oriented Language).

COBOL is now the most commonly used language for business applications on mainframes. What has this to do with microcomputers? As memory gets cheaper and the trend toward larger memories continues, COBOL is waiting in the wings for serious business programmers. Several independent software firms have released COBOL compilers, and Tandy Corporation recently announced one for the TRS-80 Model II.

The Radio Shack version has the greatest potential for widespread acceptance because of Tandy's marketing power. The compiler is software-based; there are no hardware modifications needed to run it on

the Model II. Although some of the commands found in standardized COBOL are not present in the Radio Shack compiler, the TRS-80 version represents a giant stride in providing mainframe computing tools to micros. The documentation is well written and, except for the lack of an index, provides an excellent guide to the rules of the language.

COBOL Structure

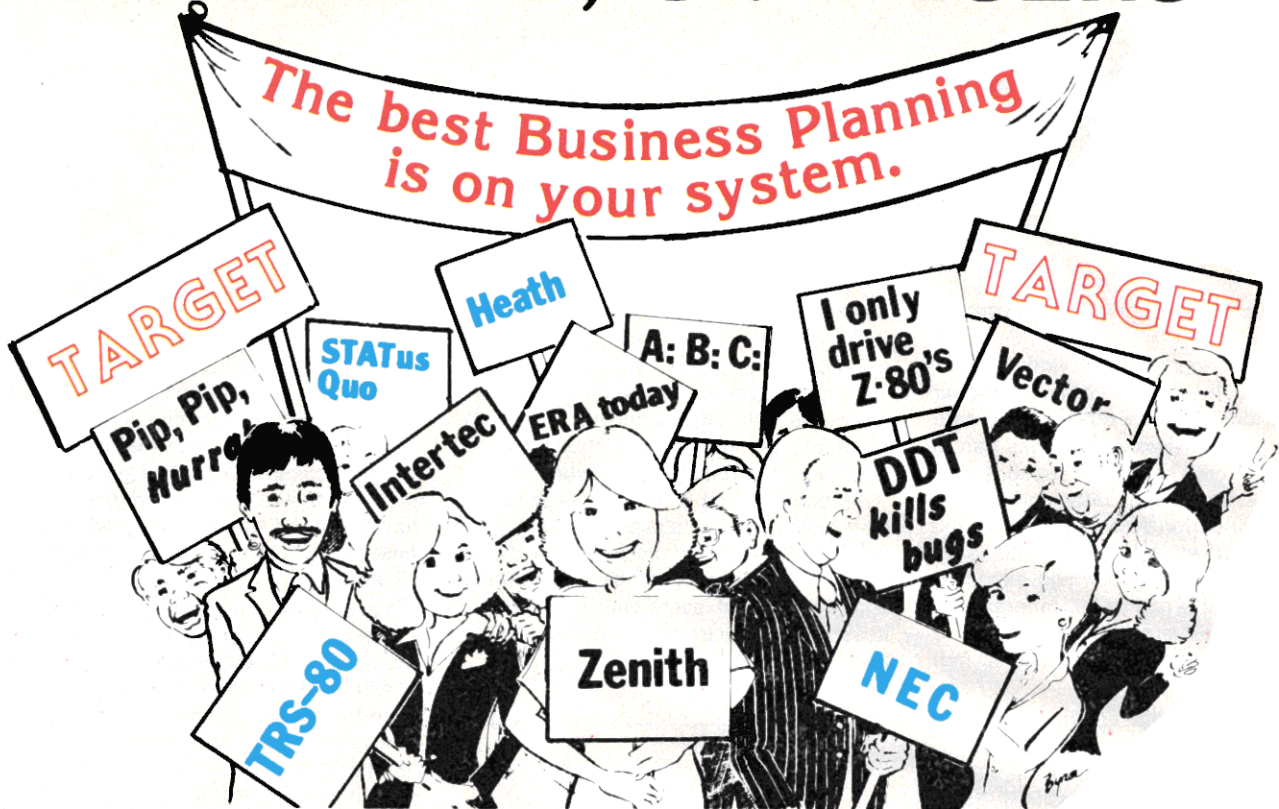
I wish to impart the flavor of the language and make a few comparisons with what we call BASIC. The application which I shall use to illustrate COBOL is simple, but by refining the programming technique I hope to demonstrate the power of the language. The purpose of the program is to calculate a few commonly used business financial ratios:

- (1) Profit margin = net income/net sales
- (2) Current ratio = current assets/current

```
IDENTIFICATION DIVISION.
PROGRAM-ID.          FINRATIO.
AUTHOR.              R L BRADLEY.
INSTALLATION.        HOME.
DATE-WRITTEN.        JULY 80.
*
* CALCULATE BUSINESS FINANCIAL RATIOS
*
```

Program Listing 1. Identification Division.

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For the past few months you have patiently endured the indignity of watching your friends show off their flashy visible number cruncher on their game-playing computer and longed for something as slick.

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Our TARGET on Your System. . .

```
LINE 1 SALES = 100 200 300 400
LINE 2 EXP = GROW 50 BY 15%
LINE 3 NET = SALES - EXP
```

Their Product on Their System. . .

```
SALES 100 200 300 400
EXP 50 + B2*1.15 + C2*1 + D2*1.15
NET + B1-B2 + C1-C2 + D1-D2 + E1-E2
```

At least, that is what their product might look like if you could see all of your data and calculation rules at the same time, *which you can't*. If you think that it is an easy approach for debugging, guess again.

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***"The Radio Shack version
(of COBOL) has the greatest potential
for widespread acceptance,
because of Tandy's marketing power."***

liabilities

(3) Quick ratio = quick assets/current liabilities

All COBOL programs are divided into four major parts. They are, in order of appearance, the identification, environment, data, and procedure divisions. Divisions can be partitioned into sections, sections into paragraphs, paragraphs into sentences.

The identification division for the sample program is shown in Listing 1. This is the type of information one would expect to find in the remarks of a BASIC program. The difference is that here it has been standardized. A COBOL comment statement, indi-

cated by the *, states the purpose of the program.

The environment division, shown in Program Listing 2, describes the hardware environment. If we were using files in this program, the relationship between their program representations and their physical counterparts would be established here.

Program Listing 3 depicts the data division. Here we define the variables which are used in the program, as indicated by the code 77. Variable names can be quite descriptive without sacrificing their uniqueness; in fact, names can be up to 30 characters in length.

```
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER.      MODELII-64K.
OBJECT-COMPUTER.      MODELII-64K.
```

Program Listing 2. Environment Division.

```
DATA DIVISION.
WORKING-STORAGE SECTION.
77 NET-INCOME          PIC S9(7)  COMP-3  VALUE 0.
77 NET-SALES           PIC S9(7)  COMP-3.
77 NET-INCOME-DISP     PIC $Z,ZZZ,ZZZ-.
77 NET-SALES-DISP      PIC $Z,ZZZ,ZZZ-.
77 PROFIT-MARGIN       PIC S99V999 COMP-3.
77 PROFIT-MARGIN-DISP  PIC -Z9.9.
```

Program Listing 3. Data Division.

```
PROCEDURE DIVISION.
PRINT-HEADING.
    DISPLAY "FINANCIAL RATIOS CALCULATION", LINE 1, POSITION 27,
    ERASE. DISPLAY "ENTER:", LINE 3, POSITION 27.
    DISPLAY "1. NET INCOME", LINE 5, POSITION 27.
    DISPLAY "2. NET SALES", LINE 7, POSITION 27.
ENTER-DATA.
    ACCEPT NET-INCOME, LINE 5, POSITION 50, PROMPT ".", CONVERT.
    MOVE NET-INCOME TO NET-INCOME-DISP.
    DISPLAY NET-INCOME-DISP, LINE 5, POSITION 50.
    ACCEPT NET-SALES, LINE 7, POSITION 50, PROMPT ".", CONVERT.
    MOVE NET-SALES TO NET-SALES-DISP.
    DISPLAY NET-SALES-DISP, LINE 7, POSITION 50.
CALCULATE-RATIO.
    DIVIDE NET-INCOME BY NET-SALES GIVING PROFIT-MARGIN ROUNDED.
    MULTIPLY PROFIT-MARGIN BY 100 GIVING PROFIT-MARGIN.
    MOVE PROFIT-MARGIN TO PROFIT-MARGIN-DISP.
PRINT-RATIO.
    DISPLAY "PROFIT MARGIN =", LINE 10, POSITION 27.
    DISPLAY PROFIT-MARGIN-DISP, LINE 10, POSITION 43.
    DISPLAY "%", LINE 10, POSITION 49.
END PROGRAM.
```

Program Listing 4. Procedure Division.

The use of the PIC (or PICTURE) clause permits the definition of both the type and format of the variable. There are essentially two types of PICTURE clauses, those for internal use (unedited) and those for input/output (edited). An example of the unedited numeric type, as seen in the definition of the net-income variable, is signed (indicated by the S) and has seven digits (the nine indicates any digit and the seven in parentheses indicates the number of digits permissible).

A decimal position would be indicated by a V, as illustrated in the definition of profit-margin. The variable net-income-disp uses an edited numeric clause. The \$ symbol will be printed in the first print position. The Z indicates that if the resulting digit is a non-significant zero, nothing will be printed (including any intervening commas). Thus, a number such as 15872 would be printed as \$ 15,872. If the number were negative, \$ 15,872- would result. The clause COMP-3 accompanies the unedited items; this indicates packed decimal representation. Variables may be initialized by use of the VALUE clause.

Several advantages of the data division are evident. First, the format establishes a variable list, an optional exercise in BASIC. If the variable names chosen are descriptive ones, this list is excellent documentation. Secondly, the format of any variable can be easily changed simply by modifying the PICTURE clause. The power of the editing features permits virtually any format of input/output. One disadvantage of COBOL is that the representation of a variable for program internal use must be distinct from that for input/output purposes when the value is numeric. Thus, two variables are sometimes required to denote the same value.

The procedure division, shown in Program Listing 4, is the part that makes things happen. Statements are grouped into paragraphs, for which the programmer must select names. A glance at the listing therefore enables one to obtain a quick summary of the actions that are taken. In this first example we are going to calculate only the profit margin. Additional statements could be used to calculate the other two ratios.

Each statement in the procedure division begins with a command called a verb. In the PRINT-HEADING paragraph the DISPLAY verb outputs messages to the CRT at the screen positions indicated. The ENTER-DATA paragraph receives the data into the program by the use of the ACCEPT verb.

"Because (COBOL) is virtually self-documenting, the time required to understand someone else's program is minimal."

The CONVERT clause in the ACCEPT statement changes the input to the format specified by COMP-3 in the data division. In order to display the edited input on the CRT, the data must be MOVED to a variable defined for that format. The purpose of the statements in the CALCULATE-RATIO and PRINT-RATIO paragraphs can be easily interpreted.

A Better Way

Although this technique will accomplish the desired task, if additional ratios are calculated, the amount of coding increases almost proportionally. We must find a more compact way to calculate several ratios. In Program Listing 5 we have selected the variable names to reflect their more generalized use. Each variable will assume several values during the course of the program. This change enables us to utilize the PERFORM verb, a command analogous to GOSUB in BASIC.

PERFORM transfers control to the paragraph specified. After the statements in that paragraph are executed, program flow is resumed at the statement following PERFORM. In this program version we have two subroutines, or paragraphs, to be PERFORMed, one for entering data and the other for calculating a ratio. With the power of the PERFORM verb we have noticeably increased the throughput of the program. We are now ready to expand the program to calculate all three ratios. The data and procedure divisions for this effort are shown in Program Listing 6. The sample run appears in Program Listing 7.

This was only a very brief glimpse at what COBOL can do. There are dozens of additional features and commands too numerous even to mention.

Your first reaction may be that it is much too wordy and time consuming, compared to BASIC. Yet this is one of COBOL's great strengths. Because it is virtually self-documenting, the time required to understand someone else's program is minimal.

A second advantage is that COBOL is easier to learn than other languages. One can memorize the rules of BASIC quickly, but effective techniques can take months to master. Because of its more rigid format and its English language syntax, the learning time for COBOL is shorter.

Your final argument against COBOL may be that you simply don't need it. The language was designed for business applications, and unless you are writing business programs which may be modified by some-

one else, you really don't need COBOL. However, the day may be approaching when microcomputer users need a stan-

dardized business language that provides easily understood programs which can be quickly modified. Many people, including

```
DATA DIVISION.
WORKING-STORAGE SECTION.
    77 ENTRY          PIC S9(7) COMP-3.
    77 ENTRY-DISP     PIC $2,ZZZ,ZZZ-.
    77 LINE-NO        PIC 99 COMP-3.
    77 VAR1           PIC S9(7) COMP-3.
    77 VAR2           PIC S9(7) COMP-3.
    77 RESULT         PIC S99V999 COMP-3.
    77 RESULT-DISP    PIC -Z9.9.
PROCEDURE DIVISION.
PRINT-HEADING.
    DISPLAY "FINANCIAL RATIOS CALCULATION", LINE 1, POSITION 27,
    ERASE. DISPLAY "ENTER:", LINE 3, POSITION 27.
    DISPLAY "1. NET INCOME", LINE 5, POSITION 27.
    DISPLAY "2. NET SALES", LINE 7, POSITION 27.
ENTER-AND-CALCULATE.
    MOVE 5 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR1.
    MOVE 7 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR2.
    PERFORM CALCULATE-RATIO.
PRINT-RATIO.
    DISPLAY "PROFIT-MARGIN =", LINE 10, POSITION 27.
    DISPLAY RESULT-DISP, LINE 10, POSITION 43.
    DISPLAY "%", LINE 10, POSITION 49.
    STOP RUN.
ENTER-DATA.
    ACCEPT ENTRY, LINE LINE-NO, POSITION 50, PROMPT ".",
    CONVERT.
    MOVE ENTRY TO ENTRY-DISP.
    DISPLAY ENTRY-DISP, LINE LINE-NO, POSITION 50.
CALCULATE-RATIO.
    DIVIDE VAR1 BY VAR2 GIVING RESULT.
    MULTIPLY RESULT BY 100 GIVING RESULT.
    MOVE RESULT TO RESULT-DISP.
END PROGRAM.
```

Program Listing 5.

```
DATA DIVISION.
WORKING-STORAGE SECTION.
    77 ENTRY          PIC S9(7) COMP-3.
    77 ENTRY-DISP     PIC $2,ZZZ,ZZZ-.
    77 LINE-NO        PIC 99 COMP-3.
    77 VAR1           PIC S9(7) COMP-3.
    77 VAR2           PIC S9(7) COMP-3.
    77 RESULT         PIC S99V999 COMP-3.
    77 RESULT-DISP    PIC -Z9.9.
    77 PERCENT        PIC 9 COMP-3.
PROCEDURE DIVISION.
PRINT-HEADING.
    DISPLAY "FINANCIAL RATIOS CALCULATION", LINE 1, POSITION 27,
    ERASE. DISPLAY "ENTER: ", LINE 3, POSITION 27.
    DISPLAY "1. NET INCOME", LINE 5, POSITION 27.
    DISPLAY "2. NET SALES", LINE 7, POSITION 27.
    DISPLAY "3. CURRENT ASSETS", LINE 9, POSITION 27.
    DISPLAY "4. CURRENT LIABILITIES", LINE 11, POSITION 27.
    DISPLAY "5. QUICK ASSETS", LINE 13, POSITION 27.
PROFIT-MARGIN.
    MOVE 5 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR1.
    MOVE 7 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR2.
    MOVE 1 TO PERCENT. PERFORM CALCULATE-RATIO. MOVE 0 TO PERCENT.
```

Program continues

Program Listing 6.

"The day may be approaching when microcomputer users need a standardized business language that provides easily understood programs."

```

DISPLAY "PROFIT MARGIN =", LINE 16, POSITION 27.
DISPLAY RESULT-DISP, LINE 16, POSITION 43.
DISPLAY "%", LINE 16, POSITION 50.
CURRENT-RATIO.
  MOVE 9 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR1.
  MOVE 11 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR2.
  PERFORM CALCULATE-RATIO.
  DISPLAY "CURRENT RATIO =", LINE 20, POSITION 27.
  DISPLAY RESULT-DISP, LINE 18, POSITION 43.
QUICK-RATIO.
  MOVE 13 TO LINE-NO. PERFORM ENTER-DATA. MOVE ENTRY TO VAR1.
  PERFORM CALCULATE-RATIO.
  DISPLAY "QUICK RATIO =", LINE 20, POSITION 27.
  DISPLAY RESULT-DISP, LINE 20, POSITION 43.
STOP RUN.
ENTER-DATA.
  ACCEPT ENTRY, LINE LINE-NO, POSITION 52, PROMPT " ".
  CONVERT.
  MOVE ENTRY TO ENTRY-DISP.
  DISPLAY ENTRY-DISP, LINE LINE-NO, POSITION 52.
CALCULATE-RATIO.
  DIVIDE VAR1 BY VAR2 GIVING RESULT.
  IF PERCENT=1, MULTIPLY RESULT BY 100 GIVING RESULT.
  MOVE RESULT TO RESULT-DISP.
END PROGRAM.

```

those at Tandy, are preparing for that day. When the time arrives, COBOL will be waiting. ■

FINANCIAL RATIOS CALCULATION

ENTER:

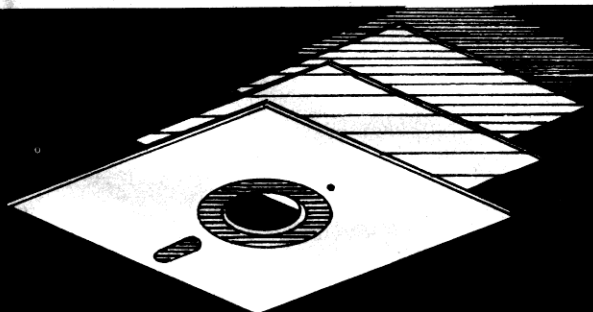
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Program Listing 7.



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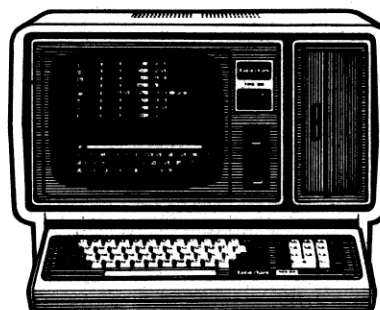
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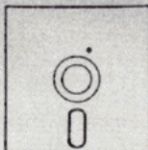
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*An introduction to an
interpreter listing for the exciting new education language.*

Pilot—The Language of Computer Aided Instruction

Randy Hawkins
6214 Hidden Cove
Corpus Christi, TX 78412

One of the most exciting applications for the home computer is computer aided instruction (CAI). Not only is the computer infinitely patient with the user, but the novelty of using a computer in learning, especially for children, keeps the user intrigued and involved during the entire lesson. A well written CAI program can both teach and entertain the student in virtually any subject area.

However, to communicate ideas and concepts to the student, the programmer must first organize his ideas and, in turn, communicate them to the computer. This involves an organized set of commands which make up a computer language. The TRS-80 uses BASIC which is both powerful and flexible, but takes time and effort to become proficient in. Often it takes months for the novice to become truly skilled in BASIC programming. This presents a problem; an expert in foreign language, for example, would be best suited for preparing a CAI

Program Listing 1. BASIC Program to Create the Pilot Interpreter.

```
10 CLEAR1000:CLS:PRINT"THIS PROGRAM WILL PREPARE A SYSTEM TAPE T
HAT CONTAINS THE":PRINT"PILOT INTERPRETER FOR THE TRS-80. THE I
NFORMATION IS NOW BEING":PRINT"PREPARED ..."
20 LN=90:FORI=1TO26:CS=0:LN=LN+10
30 FORJ=1TO8:READX:A$=A$+CHR$(X):CS=CS+X:NEXTJ:READXX:IFCS<>XXTH
ENPRINT"CHECKSUM ERROR IN LINE":LN;"-- CHECK YOUR ENTRIES.":STOP
40 NEXTI:FORI=1TO25:CS=0:LN=LN+10
50 FORJ=1TO8:READX:B$=B$+CHR$(X):CS=CS+X:NEXTJ:READXX:IFCS<>XXTH
ENPRINT"CHECKSUM ERROR IN LINE":LN;"-- CHECK YOUR ENTRIES.":STOP
60 NEXTI:A$=A$+"":ML$=CHR$(229)+CHR$(205)+CHR$(127)+CHR$(10)+CHR
$(205)+CHR$(132)+CHR$(2)+CHR$(6)+CHR$(3)+CHR$(126)+CHR$(205)+CHR
$(100)+CHR$(2)+CHR$(35)+CHR$(254)+CHR$(0)+CHR$(32)+CHR$(245)+CHR
$(16)+CHR$(245)+CHR$(205)+CHR$(248)+CHR$(1)+CHR$(225)+CHR$(201)
70 POKE16526,PEEK(VARPTR(ML$)+1):POKE16527,PEEK(VARPTR(ML$)+2):X
X=PEEK(VARPTR(A$)+1)+256*PEEK(VARPTR(A$)+2):XX=XX+65535*(XX>3276
7)-1
75 PRINT:PRINT"WHAT SIZE COMPUTER ARE YOU":INPUT"MAKING THIS TAP
E FOR (4K,16K,32K)":MS$:IFMS$="16K"THEN90
80 IFMS$="4K"THENPOKEXX+12,50:POKEXX+13,48:POKEXX+14,49:POKEXX+1
5,55:POKEXX+16,55:POKEXX+18,42:POKEXX+24,78:POKEXX+25,60:POKEXX+
29,78:POKEXX+32,78:POKEXX+44,78:POKEXX+162,79:POKEXX+267,79:POKE
XX+295,79:POKEXX+158,26:POKEXX+291,150:POKEXX+400,83:GOTO90
85 IFMS$="32K"THENPOKEXX+12,52:POKEXX+13,56:POKEXX+14,56:POKEXX+
15,52:POKEXX+16,57:POKEXX+18,58:POKEXX+24,190:POKEXX+25,172:POKE
XX+29,190:POKEXX+32,190:POKEXX+44,190:POKEXX+162,191:POKEXX+267,
191:POKEXX+295,191:POKEXX+158,106:POKEXX+291,118:POKEXX+400,195
86 IFMS$<>"32K"THEN75
90 XX=XX+1:PRINT:PRINT"PREPARE YOUR CASSETTE BY PLACING IT IN TH
E RECORD MODE.":INPUT"PRESS ENTER WHEN YOU ARE READY TO BEGIN":Z
Z$:XX=USR(XX)
```

Program continues

*"Pilot is amazingly simple,
allowing experienced programmers
and non-computerists alike
to prepare useful programs."*

program in this area, but is not likely to devote the time and energy necessary to learn BASIC programming.

Enter the Pilot language. Pilot (Programmed Inquiry Learning Or Teaching) is written expressly for computer aided instruction applications. The structure and commands of Pilot are extremely versatile and, above all, easily learned in a single session.

Pilot was developed by Dr. John Starkweather in the mid-70's. From its origins, as a method of teaching pharmacology to medical students, it has expanded to many different dialects and systems. The version presented in this article implements most of the standard features of Pilot and also utilizes some of the best features of BASIC as well as Level II text editing capabilities. Unlike several other TRS-80 Pilot interpreters, this Pilot interpreter makes it very simple to construct, load, save and execute CAI programs.

The Pilot interpreter is a machine language program which resides in the highest 300 bytes of memory. However, absolutely no knowledge of machine language is necessary to use Pilot. A BASIC program is pre-

sented which will construct a System tape containing the machine language Pilot program and even teach you how to load it. An assembly language listing of the interpreter is also included for those who may wish to study the program and possibly improve it. Finally, a Pilot program is presented to teach you the finer points of Pilot programming. This is the ultimate use of Pilot—a Pilot program to teach Pilot.

An Introduction to the Language

Let us first begin with an introduction to the Pilot language. Pilot is strictly a dialogue-oriented computer language. It will not balance your checkbook, solve trigonometry problems, or prepare a mailing list. It does, however, deal in interactive question-answer exchanges which are required for CAI applications. Pilot is amazingly simple, allowing experienced programmers and non-computerists alike to prepare useful programs. We will assume you know absolutely nothing about computer programming.

When programming the computer, you must first decide how to present the information to the student along with what infor-

mation is to be expected of the students in response to the computer's questions. The program might begin by presenting a paragraph of information, and then asking a series of questions to see if the student understands. This sequence can be reduced to the following steps:

- Type the introductory message on the screen for the student to study and learn.
- Clear the screen and ask a question to see how well the student has learned the material.
- Compare the student's response with the correct answer. If the answer is correct, proceed to the next section or question.
- Compare the student's answer with some incorrect responses and explain why, in each case, the answer was wrong. If a complete review is necessary, return to step 1. If a second try is appropriate, return to step 2.

If you understand the process illustrated above, then preparing CAI programs using Pilot should be very easy. All Pilot commands are represented by a single letter. The letters correspond to easily remembered phrases as listed below:

- T—Type the following message on the TV screen.
- A—Ask the student the following question and wait for an answer.
- M—Match the student's answer with the list of valid responses and decide whether or not they match.
- J—Jump to the listed step number.
- E—End this program.
- C—Clear the screen before typing this message.
- W—Clear the screen and type the following message in wide letters.

A Pilot command consists of one of the above command letters, followed by a quotation mark and any text needed with that command. The quotation mark is a special delimiter which separates the command letter and the rest of the statement. (Some versions of Pilot use the colon.) Only one quotation mark can be found in one Pilot statement; if quotes are needed you can substitute apostrophes for them.

Every Pilot statement must also have a line number. These numbers correspond to the step numbers used in the above discussion. The first step must have the lowest line number, the second step the second line number, and so on. When programming use multiples of 10. This way you may add

```
100 DATA85,80,73,76,79,84,32,60,569
110 DATA6,232,65,51,50,52,54,53,563
120 DATA0,45,60,2,22,64,152,126,471
130 DATA108,60,128,152,126,33,255,126,988
140 DATA34,143,65,33,227,3,34,22,561
150 DATA64,33,182,126,205,167,40,62,879
160 DATA13,205,42,3,175,33,231,65,767
170 DATA195,192,0,28,31,84,82,83,695
180 DATA45,56,48,32,80,73,76,79,489
190 DATA84,32,73,78,84,69,82,80,582
200 DATA82,69,84,69,82,32,38,34,490
210 DATA0,205,201,1,24,121,205,201,958
220 DATA1,62,23,205,42,3,24,111,471
230 DATA35,126,254,34,32,91,229,197,998
240 DATA35,126,254,0,40,3,205,167,830
250 DATA40,205,179,27,254,1,40,18,764
260 DATA193,225,24,74,42,164,64,14,800
270 DATA89,213,209,58,64,56,254,4,947
280 DATA32,1,118,126,254,0,35,32,598
290 DATA5,126,254,0,40,170,60,128,783
300 DATA24,127,244,35,94,35,86,213,858
310 DATA35,126,254,89,40,34,254,78,910
320 DATA40,30,254,84,40,38,254,65,805
330 DATA40,179,254,77,40,91,254,74,1009
340 DATA40,98,254,69,40,82,254,87,924
350 DATA40,153,254,67,40,144,24,56,778
360 DATA185,40,213,35,126,254,0,32,885
370 DATA250,35,24,179,35,126,254,34,937
380 DATA32,38,229,197,35,126,254,0,911
390 DATA40,21,254,64,40,6,205,42,672
400 DATA3,35,24,241,229,33,232,65,862
410 DATA205,167,40,225,35,24,230,62,988
420 DATA13,205,42,3,193,225,24,203,908
430 DATA33,242,127,205,167,40,225,205,1244
```

Program continues

"All Pilot commands are represented by a single letter."

```

440 DATA154,10,205,189,15,205,167,40,985
450 DATA118,14,89,35,126,254,34,32,702
460 DATA231,229,246,60,104,152,127,24,1173
470 DATA48,35,126,254,34,32,222,35,786
480 DATA197,205,90,30,42,164,64,125,917
490 DATA180,40,27,78,35,70,197,35,662
500 DATA126,187,40,3,225,24,240,35,880
510 DATA126,186,40,3,225,24,232,43,879
520 DATA43,43,193,193,24,137,193,24,850
530 DATA180,35,17,232,65,126,254,47,956
540 DATA40,28,254,0,40,24,235,70,691
550 DATA235,184,32,4,35,19,24,237,770
560 DATA35,126,254,0,40,6,254,47,762
570 DATA40,223,24,244,14,78,225,24,872
580 DATA138,69,82,82,79,82,32,73,637
590 DATA78,32,76,73,78,69,0,131,537
600 DATA120,0,0,0,0,0,0,0,120
700 PRINT:PRINT"THE MACHINE LANGUAGE PROGRAM HAS BEEN SAVED ON Y
OUR TAPE.":INPUT"PRESS ENTER WHEN YOU ARE READY TO LEARN HOW TO
USE IT":ZZ$
710 CLS:PRINT"MEMORY SIZE?":PRINT@704,"THIS IS THE WAY THE SCREE
N LOOKS AFTER YOU FIRST TURN ON THE":PRINT"TRS-80. AT THIS POIN
T, YOU SHOULD JUST PRESS ENTER -- NO NUMBERMUST BE ENTERED TO PR
ESERVE MEMORY. PRESS THE ENTER KEY NOW.":PRINT@13,CHR$(95)
720 IFINKEY$<>CHR$(13)THEN720ELSEPRINT@13," ":PRINT"RADIO SHACK
LEVEL II BASIC":PRINT"READY":PRINT">":CHR$(95);CHR$(31)
730 PRINT@704,"THE PILOT TAPE IS A MACHINE LANGUAGE PROGRAM SO Y
OU MUST USE":PRINT"THE SYSTEM COMMAND TO ENTER IT. AT THIS POINT
YOU WOULD TYPE THEWORD 'SYSTEM' LIKE THIS ..."
740 PRINT@194,,:A$="SYSTEM":FORI=1TO6:FORTI=1TO500:NEXTTI:PRINTC
HR$(24);MID$(A$,I,1);CHR$(95);:NEXTI:PRINT@862,"AND NOW PRESS EN
TER ..."
750 IFINKEY$<>CHR$(13)THEN750ELSEPRINT@199," ":PRINT@320,"* ";C
HR$(95);CHR$(31);:PRINT@704,"THE COMPUTER IS WAITING FOR THE NAM
E OF THE PROGRAM YOU WISH TO":PRINT"LOAD -- WHICH IS OF COURSE '
PILOT'. YOU SHOULD TYPE IN THE WORD'PILOT' LIKE THIS ...";
760 PRINT@324,,:A$="PILOT":FORI=1TO5:FORTI=1TO500:NEXTTI:PRINTC
HR$(24);MID$(A$,I,1);CHR$(95);:NEXTI:PRINT@862,"AND THEN PRESS EN
TER ..."
770 IFINKEY$<>CHR$(13)THEN770ELSEPRINT@329," ":CHR$(31):PRINT@70
4,"THE RECORDER WILL TURN ON (IF YOU HAVE IT IN THE PLAY SETTING
)":PRINT"AND LOAD THE SHORT PROGRAM. THE ASTERISKS WILL BLINK LI
KE THIS.":FORTI=1TO500:NEXTTI
780 PRINT@62,"*";:FORI=1TO7:FORTI=1TO100+RND(200):NEXTTI:PRINT@
63," ":FORTI=1TO100+RND(200):NEXTTI:PRINT@63,"*";:NEXTI
790 CLS:PRINT"TRS-80 PILOT INTERPRETER &":PRINT"RADIO SHACK LEVE
L II BASIC":PRINT"READY":PRINT">":CHR$(95):PRINT@704,"THE SCREEN
WILL IMMEDIATELY CLEAR LEAVING A DISPLAY LIKE THE":PRINT"ONE AB
OVE. THE PILOT INTERPRETER IS NOW ACTIVATED AND READY TO"
800 PRINT"USE. THE COMMAND 'NAME' EXECUTES THE PILOT PROGRAM.":F
ORTI=1TO1000:NEXTTI:PRINT@384,"WOULD YOU LIKE TO SEE THESE INSTR
UCTIONS AGAIN (Y/N) ?"
810 ZZ$=INKEY$:IFZZ$="Y"THEN710ELSEIFZZ$="N"THEN820ELSE810
820 PRINT"ARE YOU READY TO TRY YOUR PILOT TAPE (Y/N) ?"
830 ZZ$=INKEY$:IFZZ$="Y"THEN840ELSEIFZZ$="N"THENENDELSE830
840 POKEL6526,0:POKEL6527,0:X=USR(0)

```

statements later between steps if it becomes necessary.

Let's look at the shortest possible example program in Pilot. To print a simple message, a program of this type is needed: 10 T"THIS IS A SAMPLE PROGRAM. Note the line number, the command letter T, the quote mark and the statement text. When executed by Pilot, it will print the message and then stop with no further commands found.

To clear the screen and print the message in the upper left corner, type: 10 C"THIS IS A SAMPLE PROGRAM. Similarly, 10 W"THIS IS A SAMPLE PROGRAM. will clear the screen and print the message in wide letters (32 characters per line) in the upper left.

Although it is not required, one could add a statement to signal the end of the program. 10 T"THIS IS A SAMPLE PROGRAM. 20 E".

These three statements—T, C and W—are very useful for displaying information on the screen. In practice, more than half of the statements in a Pilot program will probably be one of these three varieties.

To ask the student a question, use the A, for ask. Since the A command will always be a question, the question mark need not be typed. For example, 10 A"WHAT IS YOUR NAME will print "WHAT IS YOUR NAME?" on the screen and wait for the student to type in his answer and then Enter. The A command can also be used to stop the program and wait for the student to Enter to continue. For example, 10 A"ARE YOU READY TO CONTINUE will print the question and also wait for the student to Enter. Until this key is pressed, the computer will wait indefinitely for that response.

When the A statement is used to halt program execution, the answer the student gives is not important. But when a specific question is asked, the student's answer is of prime importance. The input answer is stored in a special portion of the TRS-80's memory, and until another question is asked, the student's answer stays untouched in that memory location. The most recent answer can be echoed back to the student by using the @ symbol in a T statement. Whenever the computer encounters the @ symbol, it is replaced by the characters in the most recent answer. For example, 10 A"WHAT IS YOUR NAME, 20 T"HELLO @, WELCOME TO PILOT.

The first statement asks "WHAT IS YOUR NAME?" and waits for user response. The answer is stored, and when the Type command in line 20 is executed, the answer is

Program Listing 2. Pilot Program to Teach Pilot Programming.

```

10 W"PILOT IS A LANGUAGE THAT WAS
THE MACHINE LANGUAGE OF
COMPUTER AIDED
INSTRUCTION...

```

```

20 T"PILOT IS A LANGUAGE THAT WAS
CREATED BY DR. JOHN STARKWEATHER IN THE MID-70'S AND INTENDED TO
BE THE IDEAL METHOD OF USING THE COMPUTER AS A TEACHING DEVICE.

```

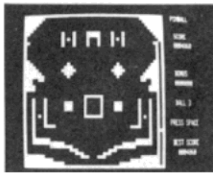
Due to a printing error, the backward apostrophes in lines 310-330 should be SHIFT @s.

Program continues

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PINBALL

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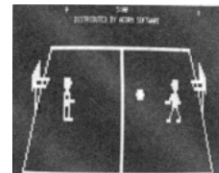
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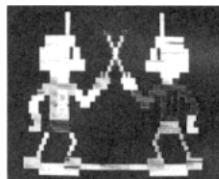


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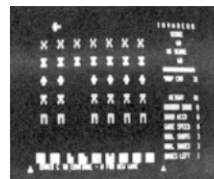


By Leo Christopherson

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30 T" THERE ARE ONLY A FEW COMMANDS USED WITH PILOT, BUT THEY ARE POWERFUL ENOUGH TO CREATE INTER-ACTIVE LEARNING PROGRAMS THAT ARE EFFECTIVE FOR THE USER AND
40 A" EASY TO CREATE. PRESS ENTER
50 W" PILOT IS TEXT ORIENTED RATHER THAN MATHEMATICALLY ORIENTED SO THAT ALMOST ANY SUBJECT AREA CAN BE PRESENTED IN A DIALOGUE-TYPE APPROACH. THE COMMANDS ARE SIMPLE AND EASILY LEARNED, SO THAT THOSE UNFAMILIAR WITH
60 T" HIGHER LEVEL LANGUAGES CAN QUICKLY ADVANCE PAST THE DETAILS OF PROGRAMMING AND CONCENTRATE ON THE INFORMATION TO BE TAUGHT TO THE STUDENT.
70 T" THIS TAPE WILL TEACH YOU PILOT PROGRAMMING BY USING THE PILOT LANGUAGE ITSELF.
80 A" PLEASE PRESS ENTER TO BEGIN
90 C" PILOT PROGRAMS USE ONLY 9 SPECIAL COMMAND SYMBOLS: T, A, M, J, E, C, W, Y, AND N. THE SYMBOLS CORRESPOND TO EASILY REMEMBERED COMMAND WORDS AS SUMMARIZED BELOW:

T = TYPE	A = ASK	M = MATCH
100 T" J = JUMP	E = END	C = CLEAR SCREEN
Y = YES	N = NO	W = WIDE LETTERS

110 T" PILOT PROGRAMS (USING THIS INTERPRETER) USE LINE NUMBERS. EACH PROGRAM STATEMENT IS NUMBERED IN ANY MANNER YOU WISH. USING THE AUTO COMMAND OF THE TRS-80, YOU AUTOMATICALLY GET LINE NUMBERS 120 T" STARTING WITH 10 AND INCREMENTING BY 10. THE PILOT PROGRAM WILL FOLLOW THESE NUMBERS WHEN IT IS RUN -- DOING THE INSTRUCTIONS AT LINE 10 FIRST, THEN THOSE AT LINE 20, LINE 30, AND SO ON. IN ADDITION, IF YOU WANT THE PROGRAM TO JUMP PAST 130 T" A SECTION OR JUMP BACK TO A PREVIOUS COMMAND WE WILL SEE HOW THE JUMP COMMAND LOOKS FOR THE LINE NUMBER YOU SPECIFY.
140 A" PLEASE PRESS ENTER TO CONTINUE
150 C" PILOT STATEMENTS ALL LOOK BASICALLY THE SAME. THERE IS ALWAYS A LINE NUMBER, FOLLOWED BY A COMMAND LETTER, A QUOTATION MARK, AND THE INSTRUCTIONS OR MESSAGE TO BE DISPLAYED. FOR EXAMPLE,
160 T" THIS SIMPLE ONE LINE PROGRAM WOULD DISPLAY THE MESSAGE
<<THIS IS THE PILOT LANGUAGE.>>

170 T" THIS INTRODUCES THE T FOR TYPE COMMAND. WHATEVER MESSAGE I FOUND AFTER THE QUOTATION MARK WILL BE TYPED OUT OR DISPLAYED ON THE VIDEO SCREEN. THERE MUST BE NO EXTRA SPACES BETWEEN THE 180 T" LETTER T AND THE QUOTATION MARK. ALSO, THE QUOTATION MARK MUST NOT BE USED IN YOUR MESSAGE. IT CAN ONLY BE USED ONCE -- TO DESIGNATE THE BEGINNING OF THE MESSAGE TO BE DISPLAYED. YOU 190 T" CAN USE SUBSTITUTE QUOTE MARKS, SUCH AS <<THESE>>.
200 A"
PLEASE PRESS THE <<ENTER>> KEY TO CONTINUE YOUR INSTRUCTIONS
210 C"

THE C AND THE W COMMANDS ARE ACTUALLY ALTERNATE TYPE COMMANDS WITH SPECIAL FEATURES. THE C COMMAND CLEARS THE SCREEN AND THEN TYPES YOUR MESSAGE AT THE TOP LEFT HAND CORNER. FOR EXAMPLE,
220 T" 10 C" THIS WILL ERASE THE SCREEN PLUS TYPE THIS MESSAGE.

230 T"
THE W COMMAND WILL DO ALL OF THE ABOVE PLUS CONVERT THE DISPLAY TO THE WIDE LETTERS (32 CHARACTERS PER LINE). FOR EXAMPLE,
10 W" THIS WILL ERASE PLUS TYPE THE MESSAGE IN WIDE STYLE.
240 A"

PLEASE PRESS ENTER WHEN YOU HAVE STUDIED THE ABOVE INFORMATION
250 W" THIS IS AN EXAMPLE OF THE WIDE LETTER OUTPUT. THE A COMMAND STANDS FOR <<ASK THIS QUESTION>> AND WAIT FOR A REPLY. AFTER
260 T" TYPING YOUR MESSAGE THE TRS-80 WILL TYPE A QUESTION MARK AND

Program continues

ALLOW THE USER TO TYPE IN AN ANSWER. FOR EXAMPLE,

270 T"

10 A"WHAT IS YOUR ANSWER

280 T"

WILL TYPE THE MESSAGE AND A

QUESTION MARK AND ALLOW THE USER TO TYPE IN HIS ANSWER AND PRESS

290 A"ENTER WHEN COMPLETED.

PRESS ENTER TO CONTINUE

300 C"WHAT HAPPENS TO THE ANSWER TYPED IN BY THE USER? IT IS ST

ORED

IN A SPECIAL AREA OF THE COMPUTER'S MEMORY AND UNTIL ANOTHER

QUESTION IS ASKED IT STAYS IN THAT SPECIAL MEMORY LOCATION.

310 T"THE PROGRAM CAN RE-PRINT THE USER'S ANSWER BY USING THE `

SIGN IN THE PROGRAM. WHEN THE ` SIGN IS FOUND IN A TYPE

STATEMENT, THE MOST RECENT USER'S ANSWER IS PRINTED RATHER THAN

THE ` SIGN. FOR EXAMPLE,

320 T" 10 A"WHAT IS YOUR ANSWER

325 T" 20 T"YOUR ANSWER OF ` IS RIGHT!

326 T"BE VERY CAREFUL WHEN TYPING -- THE ` SYMBOL AND THE SHIFT-

ARE TWO DIFFERENT CHARACTERS TO THE COMPUTER. DO NOT

ACCIDENTALLY HOLD THE SHIFT KEY DOWN WHILE TYPING THE ` SYMBOL.

330 T"WHATEVER THE USER TYPES IN RESPONSE TO THE QUESTION OF LIN

E 10

WILL BE ECHOED BACK IN LINE 20 IN PLACE OF THE ` SYMBOL.

340 A"PLEASE PRESS ENTER TO CONTINUE

350 C"THE NEXT QUESTION IS HOW DO WE USE THE ANSWER SUPPLIED BY

THE

USER -- HOW DO WE CHECK TO SEE IF IT IS RIGHT OR WRONG? THIS IS

DONE BY THE MATCH STATEMENT REPRESENTED BY THE M COMMAND.

360 T"AFTER ASKING A QUESTION BY USING THE A COMMAND, WE CAN CHE

CK

TO SEE IF IT MATCHES A LIST OF POSSIBLE RESPONSES. FOR EXAMPLE,

10 A"WHAT IS YOUR ANSWER

20 M"YES/OF COURSE/SURE/OK

370 T"THIS SIMPLE PROGRAM WAITS FOR THE USER'S ANSWER. IT THEN

COMPARES HIS RESPONSE TO THE LIST OF VALID RESPONSES. AS YOU

380 T"CAN SEE, EACH DIFFERENT RESPONSE IS SEPARATED BY A / AND A

NY

NUMBER OF ANSWERS CAN BE INCLUDED AS LONG AS SLASHES SEPARATE

THEM. SO THE ANSWER MATCHES ONE OF THE CORRECT RESPONSES --

390 A"WHAT NEXT? PRESS ENTER TO CONTINUE

400 C"IF THE USER ANSWER MATCHES ANY ONE OF THE ITEMS IN THE MAT

CH

STATEMENT, A 'FLAG' IS SET TO 'YES'. IF THE ANSWER DOES NOT

MATCH ANY ITEM, THE 'NO FLAG' IS SET. ONCE A 'FLAG' IS SET

410 T"IT REMAINS AT THAT VALUE UNTIL THE NEXT MATCH STATEMENT.

WE NOW INTRODUCE TWO NEW COMMAND LETTERS -- Y AND N -- FOR YES

AND NO. WHEN THE Y LETTER IS FOUND AT THE BEGINNING OF A

420 T"PILOT STATEMENT, IT MEANS 'IF THE YES FLAG HAS BEEN SET TH

EN

DO THIS STATEMENT -- OTHERWISE SKIP THIS STATEMENT AND MOVE TO

THE NEXT NUMBERED STATEMENT'. SIMILARLY, THE N COMMAND MEANS

'IF THE NO FLAG HAS BEEN SET DO IT -- ELSE SKIP IT'.

425 A"

WOULD YOU LIKE TO SEE AN EXAMPLE OF THE Y AND N STATEMENTS

430 C" 10 A"WHAT IS YOUR ANSWER

20 M"TEXAS

30 Y"THAT IS RIGHT!

40 N"NO, THAT IS WRONG!

440 T"

IF THE USER TYPES IN 'TEXAS' IN RESPONSE TO THE QUESTION OF

LINE 10, THE COMPUTER WILL WRITE THE MESSAGE OF LINE 30; IF IT

450 T"DOES NOT MATCH, IT WRITES THE MESSAGE OF LINE 40. ANY

STATEMENT CAN BE USED IN CONJUNCTION WITH THE Y AND N COMMANDS.

AFTER DECIDING IF THE CORRECT FLAG HAS BEEN SET, THE STATEMENT

IS EITHER EXECUTED NORMALLY OR SKIPPED COMPLETELY.

455 A"

PRESS ENTER TO CONTINUE

Program continues

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"Any Pilot statement can be either executed or skipped depending on the current value of the yes/no flag."

```
460 C"
THE FINAL PILOT COMMAND IS J FOR JUMP. A JUMP STATEMENT MAY LOOK
LIKE THIS
10 J"30
470 T"THIS WOULD TELL THE COMPUTER TO JUMP AHEAD TO THE SET OF
INSTRUCTIONS BEGINNING AT LINE 30. THE PILOT STATEMENT
50 YJ"90
480 T"WOULD JUMP TO LINE 90 IF THE YES FLAG HAD BEEN SET.
490 A"PRESS ENTER TO CONTINUE
500 C"HERE ARE SEVERAL OTHER MISCELLANEOUS HINTS AND TIPS:
```

```
> ALL STANDARD LEVEL II TEXT EDITING COMMANDS SHOULD BE USED
TO ENTER YOUR PILOT PROGRAM. THESE INCLUDE LIST, AUTO, EDIT,
NEW, AND DELETE. SEE THE LEVEL II MANUAL FOR DETAILS.
510 T"
> THE PILOT PROGRAM IS EXECUTED WITH THE 'NAME' COMMAND. THIS
COMMAND IS NOT NORMALLY USED BY THE BASIC INTERPRETER. REMEMBER
THAT BASIC IS STILL AVAILABLE AND USES THE 'RUN' COMMAND.
520 T"
> THE PILOT PROGRAMS CAN BE SAVED AND LOADED USING THE CSAVE,
CLOAD, AND CLOAD? COMMANDS OF LEVEL II BASIC. AGAIN, SEE THE
LEVEL II MANUAL FOR DETAILS.
530 A"
```

Program continues

replaced at the location of the @ symbol.

The answer can be compared to a list of other alphanumeric characters by using the Match command: 10 A"WHAT TYPE OF COMPUTER DO YOU HAVE 20 M"TRS-80. The answer supplied in line 10 is compared to the value in line 20; that is, TRS-80. If the student's answer matches the word or words or numbers in the M statement exactly, then a yes flag is set. If it does not match, a no flag is set. The response to the user's answer is remembered until another Match statement is found. More than one answer may be valid. Multiple answers can be handled by separating them with slashes: 20 M"TRS-80/ATARI/APPLE. If any one answer matches, the computer remembers yes.

Any Pilot statement can be either executed or skipped depending on the current value of the yes/no flag by adding the letter Y or N in front of the Pilot command letter. If

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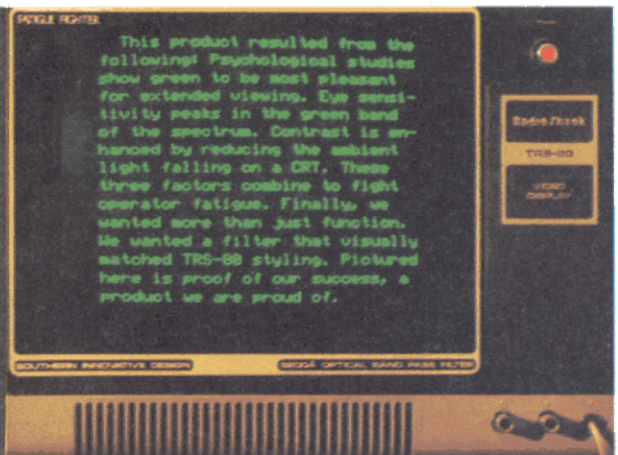
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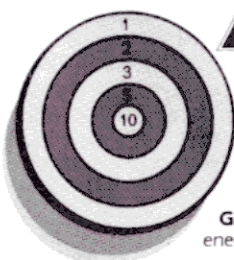
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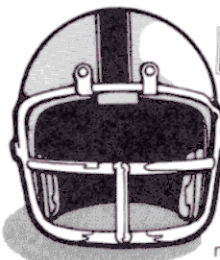
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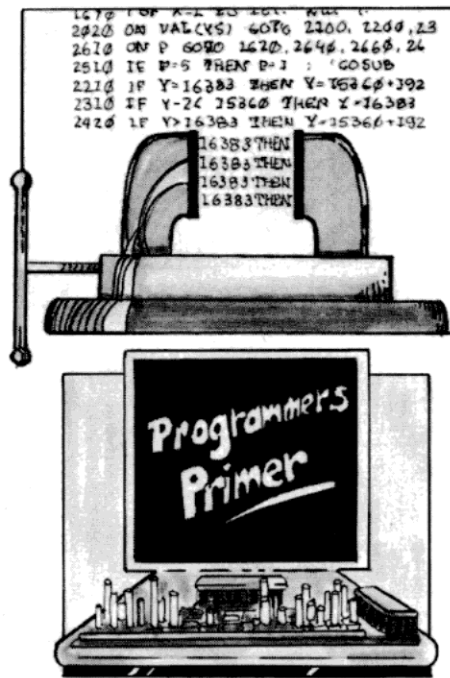
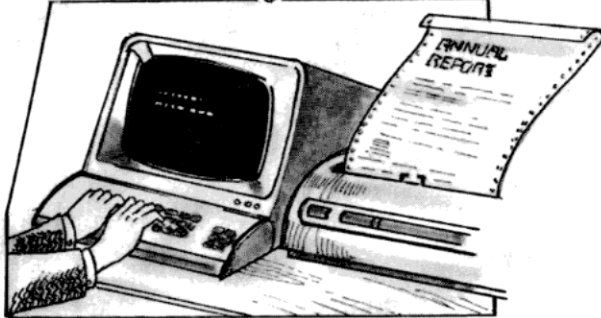
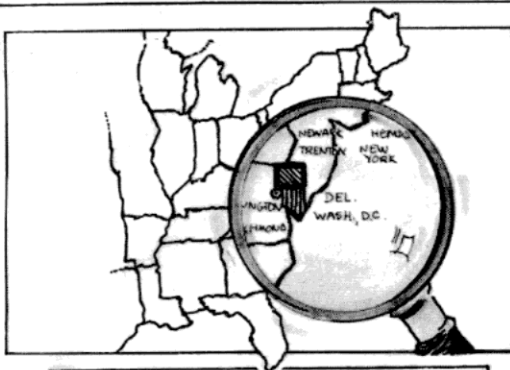
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the statement begins with Y and the previous match was a yes result, the rest of the statement will be executed normally. A statement with a Y prefix will be skipped if the no flag is set. Study the following example:

```
10 A"WHAT TYPE OF COMPUTER DO YOU HAVE
20 M"TRS-80/RADIO SHACK/LEVEL II/MODEL 1
30 YT"80 MICROCOMPUTING IS THE MAGAZINE FOR YOU!
40 NT"SORRY, YOU ARE ON YOUR OWN.
```

If the student answers any of the phrases of line 20, the message of line 30 will be printed. If some other answer is entered, the message of line 40 appears.

A J(ump) causes the computer to jump to the statement indicated. The command 10 J"99 causes the computer to jump immediately to line 99. Similarly, 10 YJ"99 will jump to line 99 if the previous match statement

```
PLEASE PRESS ENTER TO SEE AN EXAMPLE PROBLEM
600 C"THIS IS AN EXAMPLE PROBLEM USING THE PILOT INTERPRETER.
610 A"FIRST OF ALL, WHAT IS YOUR NAME
620 T"OK, @, HERE IS YOUR QUESTION. WHAT IS THE BEST
MAGAZINE FOR THE TRS-80 MICRO-COMPUTER --
    A = BETTER HOMES AND GARDENS
    B = PSYCHOLOGY TODAY
    C = 80 MICROCOMPUTING
630 T"CONSIDER THE CHOICES CAREFULLY @ AND TELL ME
640 A"IS YOUR ANSWER A , B , OR C
650 M"A
660 YT"ONLY IF YOU ARE USING YOUR COMPUTER AS A FLOWER POT! TRY AGAIN
670 YJ"640
680 M"B
690 YT"COMPUTER PROGRAMMING MUST BE DRIVING YOU CRAZY! TRY AGAIN
.
700 YJ"640
710 M"C
720 YT"YOU ARE ABSOLUTELY CORRECT! GOOD LUCK AND ENJOY USING PILOT.
730 YE"
740 T"YOU ARE NOT FOLLOWING THE DIRECTIONS!
750 J"640
```

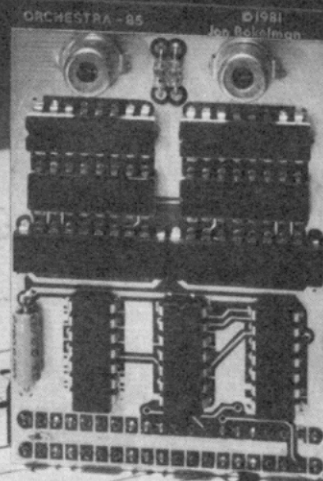
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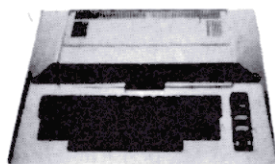
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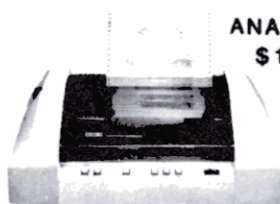
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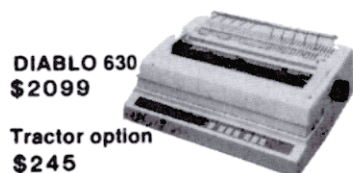
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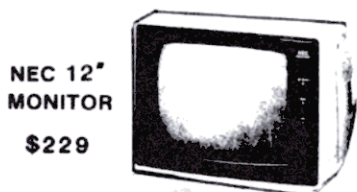


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"The use of a second set of quotation marks is totally unpredictable and is normally bad programming practice."

resulted in a yes flag.

Constructing New Programs

New programs can be constructed using the standard Level II BASIC editing commands, including Auto, Edit, New and Delete. They can be saved and loaded to cassette with the CSAVE, CLOAD and CLOAD? commands. Any error found in a program will be noted with an Error in the Line XX message.

Program Listing 1 is in BASIC and will prepare the machine language System tape that you will use at the beginning of every Pilot programming session. Type the program in as shown and run it. Follow the directions and prepare your new Pilot interpreter tape. The program also contains many double checks to make sure that there are no mistakes in your data statements. If you find a checksum error when running the program, go back and check the entries in the line number indicated.

It might be wise to devote an entire cassette to Pilot. On one side, keep the Pilot tape-maker. You can use this program to give others the Pilot interpreter. On the other side, you will create your own Pilot system tape. CSAVE the BASIC program before you actually make the Pilot interpreter. If you have made a mistake the computer will return all the way back to the memory size question. A backup copy on tape will keep you from losing the program in case of disaster.

Once you have prepared the Pilot interpreter program and followed the directions for entry, the screen should clear and TRS-80 Pilot Interpreter and Radio Shack Level II BASIC should be displayed along with the Ready prompt. Type in a simple one-line Pilot program, such as 10 T"WEL-COME TO PILOT.

In BASIC we use the command Run to begin program execution. In Pilot we use the command Name. Type Name and Enter and you should see the message above printed. Why use the word Name? The TRS-80 recognizes about 100 different words. Among these are Print, For, Next, Edit, List and others. The TRS-80 also recognizes Name, but unlike the other commands, Name has no specific function assigned to it. As a result, Pilot can borrow the Name command without affecting normal BASIC execution.

Program Listing 2 when typed in and executed, will provide an introduction to Pilot. The program occupies about 8K of memory, so 4K owners will need to break the program into smaller pieces.

Type the program in exactly as listed. To make an attractive display, the down arrow (or linefeed) is used at the end of lines. When encountered in the program, they accomplish the same thing you see on your video display—the printing jumps to the beginning of the next line. See, for example, lines 10, 20 and 30. In addition, there appear to be run-on words in line 20. However, when printed in wide characters as instructed in line 10, the display looks fine.

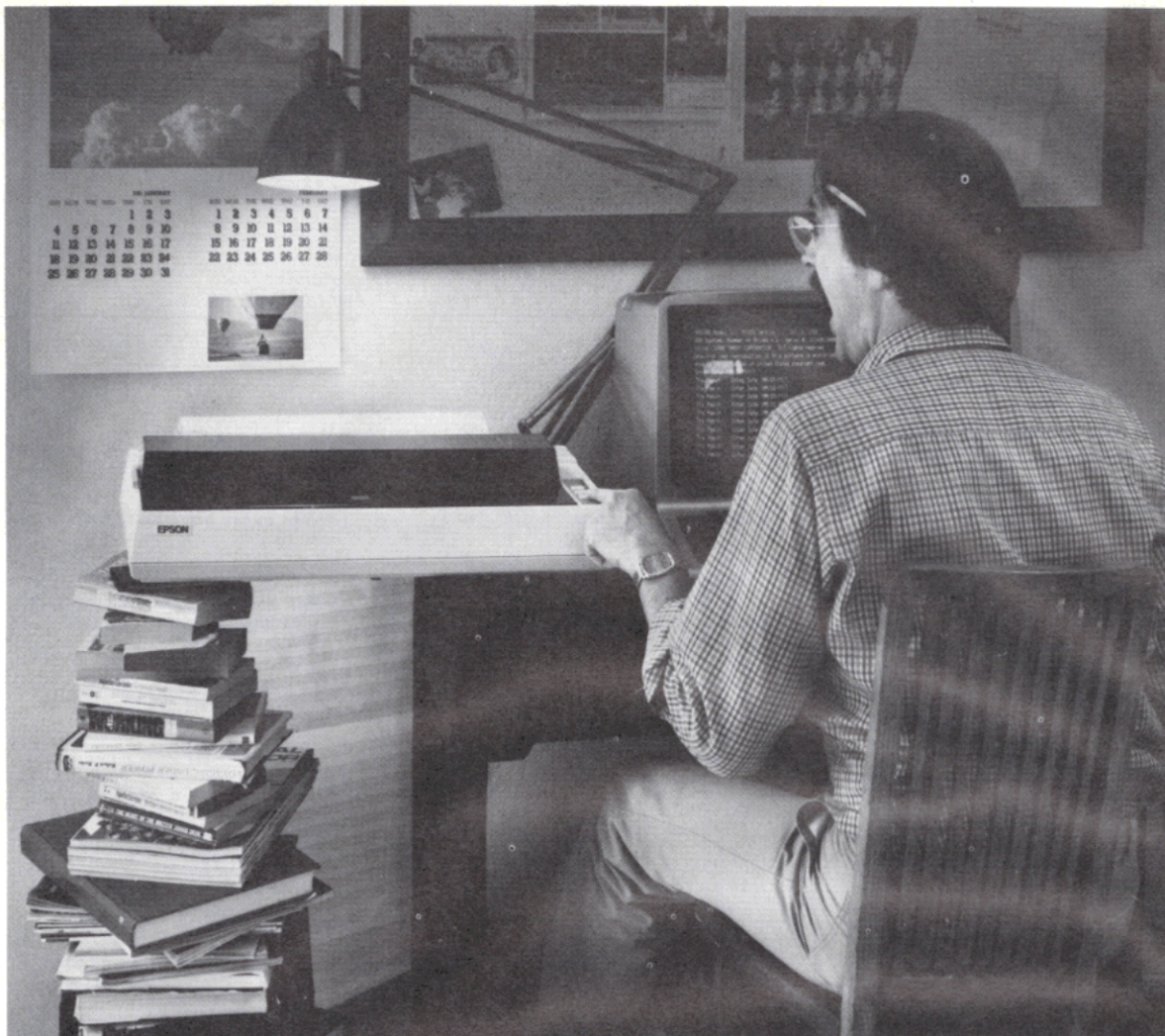
Broken Rules

Several rules are broken in the program, but for a good reason. One should not normally use a second set of quote marks in a Pilot program statement. You will find two sets in lines 160, 220 and 230. The use of a second set of quotation marks is totally unpredictable and is normally bad programming practice. Yet, in the lines above they are absolutely essential to illustrate a point and have been thoroughly tested and are

Program Listing 3. Pilot Interpreter Source Code.

```
1000      ORG      41E8H          ;SET MEMORY SIZE
1010      DEFB    '32465'
1020      DEFB    00H
1030      ORG      4016H          ;RESET KEYBOARD DRIVER TO
1040      DEFW    7E98H          ;INITIALIZATION ADDRESS
1050      ORG      7E98H
1060      LD      HL,BEGIN      ;RESET NAME COMMAND TO
1070      LD      (418FH),HL    ;PILOT INTERPRETER
1080      LD      HL,03E3H
1090      LD      (4016H),HL    ;RESET KEYBOARD DRIVER
1100      LD      HL,TITLE
1110      CALL    28A7H        ;WRITE SIGNON MESSAGE
1120      LD      A,0DH
1130      CALL    032AH
1140      XOR     A
1150      LD      HL,41E7H
1160      JP      00C0H        ;JUMP TO LEVEL II START
1170  TITLE  DEFB    1CH
1180      DEFB    1FH
1190      DEFB    'TRS-80 PILOT INTERPRETER &'
1200      DEFB    00H
1210      ORG      7ED4H
1220  CLS    CALL    01C9H      ;CLEAR SCREEN AND JUMP TO TYPE
1230      JR      TYPE
1240  WIDE   CALL    01C9H      ;CLEAR SCREEN, SWITCH TO
1250      LD      A,17H        ;WIDE LETTERS AND JUMP TO
1260      CALL    032AH        ;TYPE ROUTINE
1270      JR      TYPE
1280  ASK    INC      HL
1290      LD      A,(HL)        ;CHECK FOR QUOTES
1300      CP      22H
1310      JR      NZ,WRONG
1320      PUSH    HL
1330      PUSH    BC
1340      INC     HL
1350      LD      A,(HL)        ;IF THERE IS A MESSAGE,
1360      CP      00H          ;PRINT IT
1370      JR      Z,ASK2
1380      CALL    28A7H
1390  ASK2   CALL    1BB3H      ;WAIT FOR USER RESPONSE
1400      CP      01H
1410      JR      Z,STRT1      ;IF BREAK KEY THEN STOP
1420      POP     BC
1430      POP     HL
1440      JR      SKIP
1450  BEGIN  LD      HL,(40A4H) ;BEGIN EXECUTION, SET HL AT
1460      LD      C,'Y'        ;BEGINNING OF TEXT, SET FLAG
1470      PUSH    DE
1480  START  POP     DE
1490      LD      A,(3340H)    ;CHECK FOR BREAK KEY AND STOP
1500      CP      04H
1510      JR      NZ,STRT2
1520  STRT1  HALT
```

Program continues



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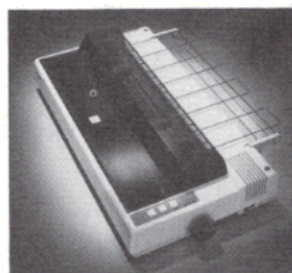
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"Several of the major computer manufacturers have announced plans to release versions of Pilot for their products in mid-1981."

guaranteed to work. Try to avoid their use in your programs.

The @ symbol in lines 310, 325 and 326 is actually a shift-@. This must be done to make the @ symbol appear on the video display. Try to use only the unshifted @ symbol for its intended purpose and avoid the shifted-@ symbol. The normal use of @ is shown in lines 620 and 630.

More experienced machine language programmers will be interested in Program Listing 3. Any editor/assembler program could be used to produce a workable object code program from this listing. Of special interest are the use of several ROM routines to both conserve memory and take advantage of the efficient coding available. Details of a few of these commonly used sub-routines are outlined below:

CALL 28A7H Prints a message on the video screen. HL must point to first byte of string. String must end with a zero byte. AF, BC, DE and HL are used.

CALL 032AH Prints the character contained in register A on the screen at current cursor location. Uses AF.

CALL 01C9H Clears screen and positions cursor at location 0.

CALL 1BB3H Prints a question mark and allows user entry as in BASIC's INPUT statement. The entry will be stored starting at 41E8H. A contains a 0 if Enter was the terminating character, 1 if the Break key was used. HL and BC are used.

CALL 0A9AH Transfers the value stored in HL to memory location 4121H and 4122H.

CALL 0FBDH Convert value in 4121H and 4122H to ASCII string and store at location 41E8H + length of string.

CALL 1E5AH Converts string starting at location HL into a numerical value and stores in DE. Uses HL, BC, and DE.

The use of absolute jumps is minimized so the code will be easy to relocate. The initialization section not only automatically sets memory size at a value sufficient to protect the routine, but also begins execution immediately upon loading. The slash and Enter keys are not needed.

The Pilot language is a fun and interesting alternative to BASIC. A wealth of information on Pilot is available in past micro-computing journals which can be used with a minimum of translation for this system. Anyone from a first-grader up should be able to learn and use Pilot after only a short introduction.

Several of the major computer manufacturers have announced plans to release versions of Pilot for their products in mid-1981, which will provide the opportunity to see what Pilot is all about. ■

```

1530 STRT2 LD A,(HL)
1540 CP 00H
1550 INC HL
1560 JR NZ,STRT4
1570 LD A,(HL)
1580 CP 00H ;TWO ZEROES IN A ROW MEAN END
1590 JR Z,STRT1
1600 STRT4 INC HL
1610 LD E,(HL) ;SAVE LINE NUMBER IN DE
1620 INC HL
1630 LD D,(HL)
1640 DE
1650 BACK INC HL ;LOAD A WITH CHARACTER AND JUMP
1660 LD A,(HL) ;TO APPROPRIATE SECTION
1670 CP 'Y'
1680 JR Z,FLAG
1690 CP 'N'
1700 JR Z,FLAG
1710 CP 'T'
1720 JR Z,TYPE
1730 CP 'A'
1740 JR Z,ASK
1750 CP 'M'
1760 JR Z,MATCH
1770 CP 'J'
1780 JR Z,JUMP
1790 CP 'E'
1800 JR Z,END1
1810 CP 'W'
1820 JR Z,WIDE
1830 CP 'C'
1840 JR Z,CLS
1850 WRONG JR ERROR ;IF NONE MATCH THEN ERROR
1860 FLAG CP C ;SEE IF CONDITIONAL MATCHES
1870 JR Z,BACK ;CURRENT FLAG IN C
1880 SKIP INC HL ;NO MATCH SO SKIP COMMAND
1890 LD A,(HL)
1900 CP 22H
1910 JR NZ,ERROR
1920 PUSH HL
1930 PUSH BC
1940 INC HL
1950 SKIP2 JR START
1960 TYPE INC HL ;TYPE STATEMENT TO VIDEO
1970 LD A,(HL)
1980 CP 22H ;CHECK FOR QUOTES
1990 JR NZ,ERROR
2000 PUSH HL
2010 PUSH BC
2020 INC HL
2030 TYPE2 LD A,(HL)
2040 CP 00H
2050 JR Z,TYPE3
2060 CP 40H ;CHECK FOR @ SIGN
2070 JR Z,BUFFER
2080 CALL 032AH ;OUTPUT CHARACTER TO SCREEN
2090 INC HL
2100 JR TYPE2
2110 BUFFER PUSH HL ;TYPE MOST RECENT
2120 LD HL,41E8H ;ANSWER TO SCREEN
2130 CALL 28A7H
2140 POP HL
2150 INC HL
2160 JR TYPE2
2170 TYPE3 LD A,0DH
2180 CALL 032AH
2190 POP BC
2200 POP HL
2210 TYPE4 JR SKIP
2220 ERROR LD HL,ERRMES ;TYPE ERROR MESSAGE AND STOP
2230 CALL 28A7H
2240 POP HL

```

Program continues

```

2250      CALL      0A9AH
2260      CALL      0FBDH
2270      CALL      28A7H
2280  END1  HALT
2290  MATCH  LD      C,'Y'      ;COMPARE ANSWER TO LIST AND
2300      INC      HL          ;SET APPROPRIATE FLAG
2310      LD      A,(HL)
2320      CP      22H
2330      JR      NZ,ERROR
2340      PUSH     HL
2350      JR      MATCH1
2360  JUMP   INC      HL          ;JUMP TO LISTED LINE NUMBER
2370      LD      A,(HL)
2380      CP      22H
2390      JR      NZ,ERROR
2400      INC      HL
2410      PUSH     BC
2420      CALL     1E5AH          ;CONVERT STRING TO NUMBER IN DE
2430      LD      HL,(40A4H)
2440  JUMP2  LD      A,L
2450      OR      H
2460      JR      Z,JUMP4          ;LINE NOT FOUND SO PRINT ERROR
2470      LD      C,(HL)
2480      INC      HL
2490      LD      B,(HL)
2500      PUSH     BC          ;SAVE NEXT LOCATION
2510      INC      HL
2520      LD      A,(HL)
2530      CP      E
2540      JR      Z,JUMP3
2550      POP      HL
2560      JR      JUMP2
2570  JUMP3  INC      HL
2580      LD      A,(HL)
2590      CP      D
2600      JR      Z,LINE          ;IF MATCH GOTO LINE
2610      POP      HL
2620      JR      JUMP2
2630  LINE   DEC      HL          ;RESET HL TO PROPER LOCATION
2640      DEC      HL
2650      DEC      HL
2660      POP      BC
2670      POP      BC
2680      JR      SKIP2
2690  JUMP4  POP      BC
2700      JR      ERROR
2710  MATCH1 INC      HL          ;POINT TO TEXT ANSWER
2720      LD      DE,41E8H        ;POINT TO USER'S ANSWER
2730  MATCH2 LD      A,(HL)
2740      CP      2FH          ;CHECK FOR SLASH
2750      JR      Z,MATCH3
2760      CP      00H          ;CHECK FOR END OF LINE
2770      JR      Z,MATCH3
2780      EX      DE,HL
2790      LD      B,(HL)
2800      EX      DE,HL
2810      CP      B
2820      JR      NZ,FAIL
2830      INC      HL
2840      INC      DE
2850      JR      MATCH2
2860  FAIL   INC      HL          ;NO MATCH THIS TIME
2870      LD      A,(HL)
2880      CP      00H          ;CHECK FOR END OF LINE
2890      JR      Z,SETFLG
2900      CP      2FH          ;CHECK FOR SLASH
2910      JR      Z,MATCH1
2920      JR      FAIL
2930  SETFLG LD      C,'N'      ;SET FLAG TO NO
2940  MATCH3 POP      HL
2950      JR      TYPE4
2960  ERRMES DEFM     'ERROR IN LINE'
2970      DEFB     00H
2980      END

```

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Program Listing 4.

```
00000 ; TRS-80 PILOT INTERPRETER
00010 ;
00020 ; BY RANDY HAWKINS
00030 ; 6214 HIDDEN COVE
00040 ; CORPUS CHRISTI, TEX
00050 ;
00060 ; THIS PROGRAM LOADS THE PILOT INTERPRETER
00070 ; INTO HIGH MEMORY OF A 16K CASSETTE BASED
00080 ; SYSTEM ... ABSOLUTE JUMPS ARE KEPT TO A
00090 ; MINIMUM TO MAKE RELOCATION SIMPLEST.
00095 ;
41E8 00100 ORG 41E8H ;LOAD BUFFER WITH
41E8 33 00110 DEFM '32465' ;PROPER MEMORY SIZE
41ED 00 00120 DEFB 00H ;ZERO MARKS END
4016 00130 ORG 4016H ;RESET KEYBOARD DCB
4016 987E 00140 DEFW 7E98H ;TO INITIALIZATION
7E98 00150 ORG 7E98H
7E98 21FF7E 00160 LD HL,BEGIN ;DEFINE 'NAME'
7E9B 228F41 00170 LD (418FH),HL ;COMMAND TO XEQ
7E9E 21E303 00180 LD HL,03E3H
7EA1 221640 00190 LD (4016H),HL ;RESET KEYBOARD
7EA4 21B67E 00200 LD HL,TITLE ;DISPLAY TITLE
7EA7 CDA728 00210 CALL 28A7H ;ROM ROUTINE
7EAA 3E0D 00220 LD A,0DH
7EAC CD2A03 00230 CALL 032AH
7EAF AF 00240 XOR A ;JUMP INTO ROM
7EB0 21E741 00250 LD HL,41E7H ;AFTER MEM SIZE
7EB3 C3C000 00260 JP 00C0H ;QUESTION
7EB6 1C 00270 TITLE DEFB 1CH
7EB7 1F 00280 DEFB 1FH
7EB8 54 00290 DEFM 'TRS-80 PILOT INTERPRETER &'
7ED3 00 00300 DEFB 00H
7ED4 00310 ORG 7ED4H
7ED4 CDC901 00320 CLS CALL 01C9H ;CLEAR SCREEN
7ED7 1879 00330 JR TYPE
7ED9 CDC901 00340 WIDE CALL 01C9H ;CLEAR SCREEN
7EDC 3E17 00350 LD A,17H ;AND SWITCH TO
7EDE CD2A03 00360 CALL 032AH ;WIDE LETTERS
7EE1 186F 00370 JR TYPE
7EE3 23 00380 ASK INC HL
7EE4 7E 00390 LD A,(HL) ;CHECK FOR QUOTE
7EE5 FE22 00400 CP 22H
7EE7 205B 00410 JR NZ,WRONG
7EE9 E5 00420 PUSH HL
7EEA C5 00430 PUSH BC
7EEB 23 00440 INC HL ;IS THERE A MESSAGE
7EEC 7E 00450 LD A,(HL) ;AFTER THE QUOTE?
7EED FE00 00460 CP 0 ;IF NOT, THEN GO
7EEF 2803 00470 JR Z,ASK2 ;AHEAD TO ASK2 ...
7EF1 CDA728 00480 CALL 28A7H ;TYPE MESSAGE
7EF4 CDB31B 00490 ASK2 CALL 1BB3H ;THEN USE ROM
7EF7 FE01 00500 CP 01H ;ROUTINE TO ACCEPT
7EF9 2812 00510 JR Z,STRT1 ;ANSWER
7EFB C1 00520 POP BC
7EFC E1 00530 POP HL
7EFD 184A 00540 JR SKIP
7EFF 2AA440 00550 BEGIN LD HL,(40A4H) ;FIND TEXT START
7F02 DE59 00560 LD C,'Y' ;SET YES/NO FLAG
7F04 D5 00570 PUSH DE
7F05 D1 00580 START POP DE
7F06 3A4038 00590 LD A,(3840H) ;CHECK FOR BREAK
7F09 FE04 00600 CP 04H
7F0B 2001 00610 JR NZ,STRT2
7F0D 76 00620 STRT1 HALT ;JUMP TO 'READY'
7F0E 7E 00630 STRT2 LD A,(HL)
7F0F FE00 00640 CP 00H ;CHECK END OF
7F11 23 00650 INC HL ;TEXT ... IF NOT
7F12 2005 00660 JR NZ,STRT4 ;THEN CONTINUE
```

Program continues

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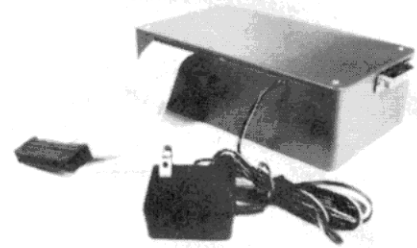
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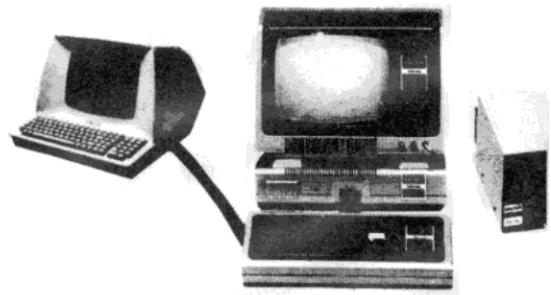
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7F14 7E	00670	LD	A, (HL)	;THIRD ZERO IN A
7F15 FE00	00680	CP	00H	;ROW MEANS GO TO
7F17 28F4	00690	JR	Z,STRT1	;HALT AT STRT1
7F19 23	00700	INC	HL	
7F1A 5E	00710	LD	E, (HL)	;SAVE PRESENT LINE
7F1B 23	00720	INC	HL	;NUMBER IN DE
7F1C 56	00730	LD	D, (HL)	;REGISTER PAIR
7F1D D5	00740	PUSH	DE	;AND SAVE IN STACK
7F1E 23	00750	BACK INC	HL	;LOAD A WITH THE
7F1F 7E	00760	LD	A, (HL)	;COMMAND CHARACTER
7F20 FE59	00770	CP	'Y'	;AND JUMP TO THE
7F22 2822	00780	JR	Z,FLAG	;INDICATED SECTION
7F24 FE4E	00790	CP	'N'	
7F26 281E	00800	JR	Z,FLAG	
7F28 FE54	00810	CP	'T'	
7F2A 2826	00820	JR	Z,TYPE	
7F2C FE41	00830	CP	'A'	
7F2E 28B3	00840	JR	Z,ASK	
7F30 FE4D	00850	CP	'M'	
7F32 285B	00860	JR	Z,MATCH	
7F34 FE4A	00870	CP	'J'	
7F36 2862	00880	JR	Z,JUMP	
7F38 FE45	00890	CP	'E'	
7F3A 2852	00900	JR	Z,END1	
7F3C FE57	00910	CP	'W'	
7F3E 2899	00920	JR	Z,WIDE	
7F40 FE43	00930	CP	'C'	
7F42 2890	00940	JR	Z,CLS	
7F44 1838	00950	WRONG JR	ERROR	;SORRY, NO MATCH
7F46 B9	00960	FLAG CP	C	;COMPARE TO FLAG
7F47 28D5	00970	JR	Z,BACK	
7F49 23	00980	SKIP INC	HL	;SKIP FORWARD TO
7F4A 7E	00990	LD	A, (HL)	;START OF NEXT
7F4B FE00	01000	CP	0	;LINE SINCE FLAGS
7F4D 20FA	01010	JR	NZ,SKIP	;DID NOT MATCH
7F4F 23	01020	INC	HL	
7F50 18B3	01030	SKIP2 JR	START	
7F52 23	01040	TYPE INC	HL	
7F53 7E	01050	LD	A, (HL)	;CHECK FOR QUOTE
7F54 FE22	01060	CP	22H	; & JUMP TO
7F56 2026	01070	JR	NZ,ERROR	;ERROR MESS
7F58 E5	01080	PUSH	HL	
7F59 C5	01090	PUSH	BC	
7F5A 23	01100	INC	HL	
7F5B 7E	01110	TYPE2 LD	A, (HL)	;END OF LINE?
7F5C FE00	01120	CP	0	
7F5E 2815	01130	JR	Z,TYPE3	
7F60 FE40	01140	CP	40H	;CHECK FOR @
7F62 2806	01150	JR	Z,BUFFER	
7F64 CD2A03	01160	CALL	032AH	;PRINT CHAR. IN
7F67 23	01170	INC	HL	;A REGISTER AND
7F68 18F1	01180	JR	TYPE2	;CONTINUE ...
7F6A E5	01190	BUFFER PUSH	HL	;PRINT THE
7F6B 21E841	01200	LD	HL,41E8H	;CONTENTS OF
7F6E CDA728	01210	CALL	28A7H	;THE ANSWER
7F71 E1	01220	POP	HL	;BUFFER
7F72 23	01230	INC	HL	
7F73 18E6	01240	JR	TYPE2	
7F75 3E0D	01250	TYPE3 LD	A,0DH	;PRINT A
7F77 CD2A03	01260	CALL	032AH	;CARRIAGE
7F7A C1	01270	POP	BC	;RETURN
7F7B E1	01280	POP	HL	
7F7C 18CB	01290	TYPE4 JR	SKIP	
7F7E 21F27F	01300	LD	HL,ERRMES	;IDENTIFY
7F81 CDA728	01310	CALL	28A7H	;LINE NO.
7F84 E1	01320	POP	HL	;THAT HAS
7F85 CD9A0A	01330	CALL	0A9AH	;ERROR
7F88 CDBD0F	01340	CALL	0FBDH	
7F8B CDA728	01350	CALL	28A7H	
7F8E 76	01360	END1 HALT		

Program continues

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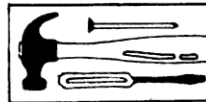
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7F8F 0E59	01370	MATCH	LD	C, 'Y'	;SET FLAG TO YES
7F91 23	01380		INC	HL	
7F92 7E	01390		LD	A, (HL)	;LOOK FOR QUOTES
7F93 FE22	01400		CP	22H	
7F95 20E7	01410		JR	NZ, ERROR	
7F97 E5	01420		PUSH	HL	
7F98 1830	01430		JR	MATCH1	;CONT AT MATCH1
7F9A 23	01440	JUMP	INC	HL	
7F9B 7E	01450		LD	A, (HL)	;LOOK FOR QUOTES
7F9C FE22	01460		CP	22H	
7F9E 20DE	01470		JR	NZ, ERROR	
7FA0 23	01480		INC	HL	
7FA1 C5	01490		PUSH	BC	;PUT TARGET LINE
7FA2 CD5A1E	01500		CALL	1E5AH	;NUMBER IN DE
7FA5 2AA440	01510		LD	HL, (40A4H)	
7FA8 7D	01520	JUMP2	LD	A, L	;HAVE WE REACHED
7FA9 B4	01530		OR	H	;END OF TEXT?
7FAA 281B	01540		JR	Z, JUMP4	
7FAC 4E	01550		LD	C, (HL)	;NEXT LINE ADDRESS
7FAD 23	01560		INC	HL	;IS SAVED IN THE
7FAE 46	01570		LD	B, (HL)	;BC REGISTER PAIR
7FAF C5	01580		PUSH	BC	
7FB0 23	01590		INC	HL	
7FB1 7E	01600		LD	A, (HL)	;IS THIS LINE
7FB2 BB	01610		CP	E	;THE SAME AS
7FB3 2803	01620		JR	Z, JUMP3	;TARGET NUMBER
7FB5 E1	01630		POP	HL	
7FB6 18F0	01640		JR	JUMP2	
7FB8 23	01650	JUMP3	INC	HL	;FIRST NUMBER DID
7FB9 7E	01660		LD	A, (HL)	;MATCH -- DOES THE
7FBA BA	01670		CP	D	;SECOND?
7FBB 2803	01680		JR	Z, LINE	
7FBD E1	01690		POP	HL	
7FBE 18E8	01700		JR	JUMP2	
7FC0 2B	01710	LINE	DEC	HL	;TRANSFER CONTROL
7FC1 2B	01720		DEC	HL	;TO THIS LINE AFTER
7FC2 2B	01730		DEC	HL	;RESTORING POINTER
7FC3 C1	01740		POP	BC	
7FC4 C1	01750		POP	BC	
7FC5 1889	01760		JR	SKIP2	
7FC7 C1	01770	JUMP4	POP	BC	
7FC8 18B4	01780		JR	ERROR	
7FCA 23	01790	MATCH1	INC	HL	;COMPARE THE ANSWER
7FCB 11E841	01800		LD	DE, 41E8H	;IN THE STANDARD
7FCE 7E	01810	MATCH2	LD	A, (HL)	;LEVEL II BUFFER
7FCF FE2F	01820		CP	2FH	;WITH THE LIST
7FD1 281C	01830		JR	Z, MATCH3	;IN THE PROGRAM
7FD3 FE00	01840		CP	0	
7FD5 2818	01850		JR	Z, MATCH3	
7FD7 EB	01860		EX	DE, HL	
7FD8 46	01870		LD	B, (HL)	
7FD9 EB	01880		EX	DE, HL	
7FDA B8	01890		CP	B	
7FDB 2004	01900		JR	NZ, FAIL	
7FDD 23	01910		INC	HL	
7FDE 13	01920		INC	DE	
7FDF 18ED	01930		JR	MATCH2	
7FE1 23	01940	FAIL	INC	HL	;THIS DID NOT MATCH
7FE2 7E	01950		LD	A, (HL)	
7FE3 FE00	01960		CP	0	;END OF LINE?
7FE5 2806	01970		JR	Z, SETFLG	
7FE7 FE2F	01980		CP	2FH	;OR JUST A SLASH?
7FE9 28DF	01990		JR	Z, MATCH1	
7FEB 18F4	02000		JR	FAIL	
7FED 0E4E	02010	SETFLG	LD	C, 'N'	;SET FLAG TO NO
7FEF E1	02020	MATCH3	POP	HL	
7FF0 188A	02030		JR	TYPE4	
7FF2 45	02040	ERRMES	DEFM	'ERROR IN LINE'	
7FFF 00	02050		DEFB	00H	
0000	02060		END		
00000		TOTAL ERRORS			

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The action is fast and furious as you frantically try to bang your button before your opponent does. As you both name songs correctly, the score goes higher and higher, but each time you seem to win more money when you name a song than when your opponent does. Finally, you have won the first round by a score of three songs to two.

Each round has a different point value. The first two rounds are worth ten points, and the third is worth 20. A tie splits the points evenly between the two contestants.

There is a pause in the action as a commercial comes on. After a pause, the monitor clears, and seven numbered lights appear. Your opponent chooses one, and a cryptic clue is revealed. The song auction has begun. You bid on the song:

"I can Name that Song in 7 notes"

"I can Name that Song in 6 notes"

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And after a long pause, your opponent says:

"Name that Song!!"

The audience quiets and the special guest musician, Trumpeter Willie Makeit, plays the five notes. Can you name that song? You type a title and hesitantly press enter, but the computer emits a loud raspberry...The audience groans—You had the wrong song in mind...

The round ends when the seven clues are all revealed. The current leader is announced, and the program again pauses for a short commercial. The action continues...

The large graphic timer is set for 30 seconds, and slowly begins ticking away. The songs come quickly, one after another, as you frantically attempt to hit your buzzer before your opponent so you can have a chance to name that familiar tune.

You find yourself ahead as the clock winds down toward zero, and shrewdly stop entering titles and let the songs play to their finish to use up precious (for your opponent) time. But hold everything—your opponent seems to have caught up!

You anxiously await the next song so you can regain your lead, but it is too late... The timer has reached zero and the third round ends in a tie.

This great party game is supplied with over 100 songs. On the disk are the files "Potluck" with many types of music, "Broadway" with show tunes, "Children" containing popular nursery songs, and Popscore with recent rock songs from popular groups such as the Beatles and Billy Joel.

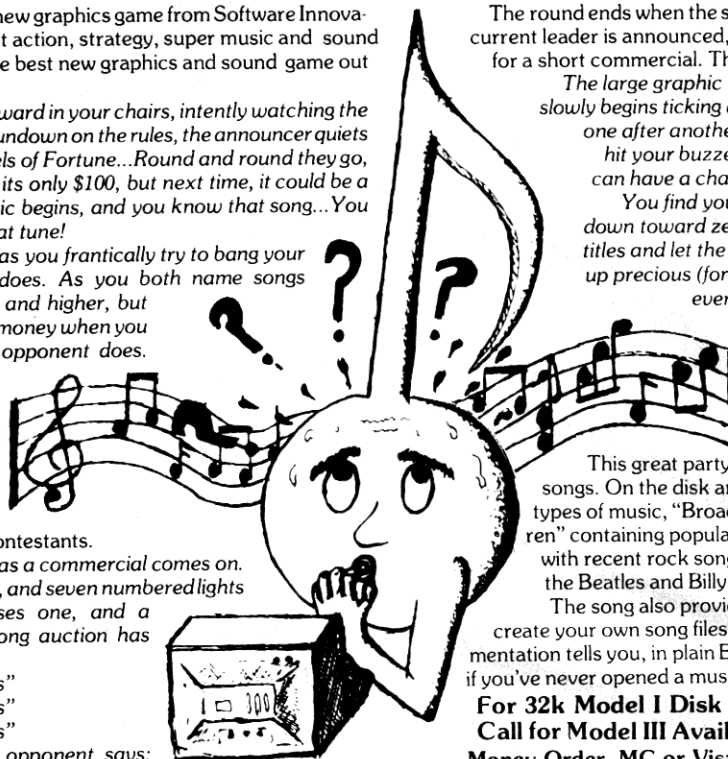
The song also provides a utility which allows you to create your own song files. It is easy to use, and the documentation tells you, in plain English, how to enter music even if you've never opened a music book in your life!

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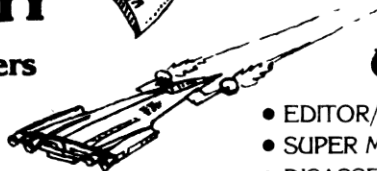
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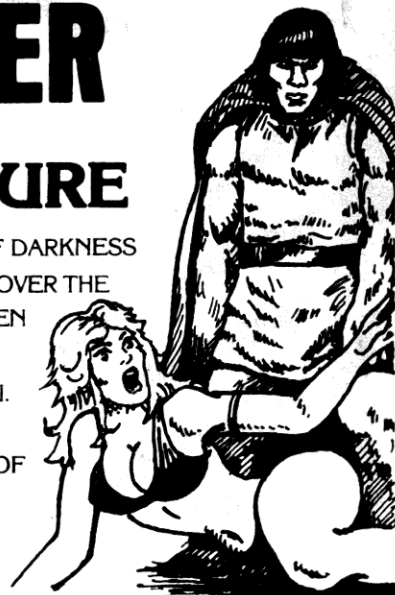
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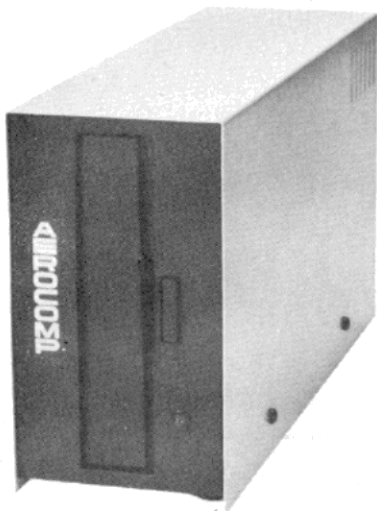
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Radio Shack's Tiny Pascal comes with a user's manual which is a model of brevity. The manual wasn't intended to be an instructional text on Pascal programming: If you are a beginner, you will have to learn by the discovery method.

The user's manual defines Tiny Pascal as "a complete, self-contained operating system for creating, running, saving and loading Pascal programs for the TRS-80." The minimum system requirement is Level II, 16K, although a 32K version is provided on the other side of the tape. The system consists of three subsystems loaded together and simultaneously present in RAM. These are the monitor, the compiler and the editor. The Run, Save and Load commands are given from the monitor mode. The monitor also provides access to the compiler and the editor.

Although Tiny Pascal employs the syntax of standard Pascal, it is a limited subset of the standard language. Several variable types and library functions are not present in the tiny version. Even so, Tiny Pascal is

fast, efficient and easier to read than BASIC.

Getting Started

Tiny Pascal is loaded via the system command, using Pascal as the file name. After a successful load, you will see the name and version number followed by the prompt ".". You are now in the monitor mode. A sample program is always loaded with the system.

There are 10 monitor commands listed in the manual, one of which is R for Run. Since you are in the monitor mode now, and there is a program present, enter R. The message returned is: "P-Code not in memory." What's wrong?

Only the source code is present in memory. Pascal is a high-level language that is not executed statement by statement, like BASIC. The code interpreted by the Pascal system is a low-level language called P-Code. To compile, enter C. As compilation takes place, the source code appears line by line. Finally, a summary line appears, containing the number of codes and the memory locations of the compiled code.

Now enter R to run the program.

There are two remaining editor commands, R and X. X has the same function as in the Level II editor, extending the line to add additional characters, or deleting characters at the end of the line by backspacing. R is used for replacing the current line. It is not followed by Enter, but by the string

which is to replace the current line.

There is no editor command to change characters within a line. If an error has been made toward the end of a line, the X command can be used to make the necessary correction. Otherwise, there is no alternative to retyping the line (use the R command). For this reason, it is a good idea to keep lines short and avoid multiple statement lines.

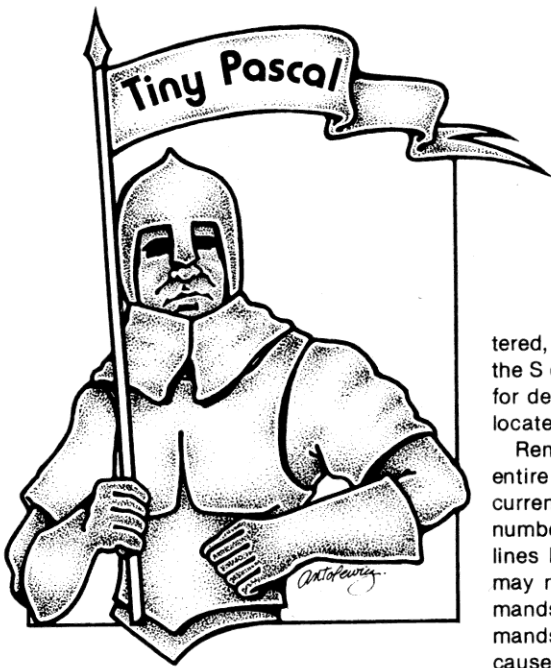
Entering a New Program

To become familiar with the syntax of Pascal, let's delete the existing program and enter a new one, observing various features as they occur.

```
(*SUM AND DIFFERENCE PROGRAM*)
CONST FIRST = 12;SECOND = 3;
VAR SUM, DIFF:INTEGER;
BEGIN
  SUM := FIRST + SECOND;
  DIFF := FIRST - SECOND;
  WRITE('THE SUM OF ',FIRST,' AND ',SECOND,' IS ',
    SUM,13);
  WRITE('THE DIFFERENCE BETWEEN ',FIRST,' AND ',
    SECOND,' IS ',DIFF);
END.
```

Although the Pascal editor is line oriented, observe that no line numbers are used. For easier reference to the program, however, I will refer to the lines by number.

The first line is a comment and is not executed. Parentheses and asterisks are needed to enclose remarks.



The words First and Second are constants which will be used in the program. In Pascal, all identifiers must be named before being used, in order to reserve memory locations for them. The second line, which begins with the keyword CONST, is the declaration statement for the constants. If we had written the numbers 12 and 3 directly into the program, they would be called "literals" rather than constants.

The advantage of using the CONST statement is more apparent in a program which uses constants repeatedly. To change the value of a constant, simply change the declaration statement rather than each occurrence of the constant.

The third line is the declaration line for variables to be used in the program. The word Integer following the list of names indicates the data type of the variables. Larger versions of Pascal support several data types, but Tiny Pascal supports only integers and integer arrays. (All punctuation in the statement is necessary.)

Letters to the Editor

To gain access to the editor, enter E from the monitor mode. You will see a status report: "FILE HAS 12 LINES 344 BYTES (498E-4AE5) PTR AT LINE 1." This is followed by > which is the prompt for an editor command. Enter P* and you will see all twelve lines of the sample program on the screen. Now enter Q to exit from the editor mode and return to the monitor.

If you try to run the program again, you will find that the P-Code is no longer in memory, and the program must be recompiled. This time after you enter C to compile, notice the location of the compiled code. The source code was located between 498E and 4BB2; the object code occupies the memory immediately above the source code.

Enter E again. The status report, which is displayed as soon as the editor mode is en-

tered, may be called back anytime by using the S command. It will be especially useful for determining where the pointer (PTR) is located.

Remember the command P* that lists the entire file? A P without the * lists only the current line; P followed by a one or two-digit number results in a list of that number of lines beginning with the current line. You may move the line pointer with the commands U for up or N for next. These commands may be followed by an * which causes the line pointer to move to the first line or the last line, respectively. Following U or N by a one or two-digit number results in the line pointer moving up or down the number of lines indicated.

Using U to indicate up may result in the unfortunate error of thinking that its opposite must be D for down. D actually deletes a line, and may be used with the variations Dnn, to delete a specified number of lines, and D* to delete the entire file.

To insert new lines, enter I. The new line or lines will be inserted immediately after the line currently pointed to. The prompt ? is used to indicate the insert mode. To exit from insert mode, press Enter at the beginning of a new line. The command to delete the entire file, D*, automatically puts you into insert mode.

Two difficulties may be encountered in insert mode: I could find no direct way to insert a new line above the first line in the file. The problem can be solved by inserting the new line after the first line, retyping the original first line to follow the new one, and deleting the extra line.

The other problem occurs if you delete an entire file and then attempt to load a new program from tape. The delete command, D* automatically invokes the insert mode. The only way to return to the monitor is to Enter a program line. This annoyance can be avoided altogether; deletion of the existing file takes place automatically when a new program is loaded.

Identifier names may consist of any alphanumeric characters, but must begin with a letter. Keywords or reserved words, such as those used for commands, functions and operators, cannot be used as identifiers. Although only four characters are recognized, names may be longer, as in BASIC. For example, any words in this program which begin with the letters FIRS or SECO will be indistinguishable from the constants FIRST and SECOND.

The actual program steps are in lines five through eight, between Begin and End. (The

"Larger versions of Pascal support several data types, but Tiny Pascal supports only integers and integer arrays."

period is required following End.) In Pascal, line indentation has no significance for the compiler. But indentation can help you visualize program structure. In Tiny Pascal, the right arrow causes a three-space tab for convenient indentation.

Lines five, six, seven and eight each contain a single Pascal statement. Statements are separated from each other by semicolons. Placing a semicolon after the last statement before End is optional. Although they may cause editing difficulties, multiple statement lines are allowed. No line can exceed 130 characters.

Lines five and six are assignment statements; notice the use of the symbol :=. Unlike BASIC, there are two separate symbols for equality and assignment in Pascal. They are = and :=, and cannot be used interchangeably. The assignment statement copies data rather than moving it.

The first Write statement (line seven) consists of seven elements separated by commas. Strings are enclosed by single quotation marks. First#, Second# and Sum# in the Write statement are instructions to print the values as decimal numbers. To output hexadecimal values, affix the character % to the variable name. The last instruction, 13, is the control code for carriage return/line feed.

Read Input

The program can be made more versatile with the use of READ statements for entering different values for First and Second. Delete the CONST declaration statement and rewrite the VAR declaration to include First and Second as variables. Move the pointer until it is at the beginning of the third line (BEGIN); enter I to insert new lines after line three. Enter the following four lines, then press Enter again to exit from the insert mode:

```
WRITE('THE FIRST NUMBER IS ');
READ(FIRST#);
WRITE(13,'THE SECOND NUMBER IS ');
READ(SECOND#);
```

Return to the monitor (Enter Q) to compile the new variation. Instead of typing C to compile, try C/P. This monitor command compiles the source code without generating P-Code. This is a compiler dry run used to check for syntax errors before actually compiling the program. A third compiling command, C/S, is used for long programs that require overwriting the source code to complete compilation. The C/P

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"A good way to learn about the idiosyncracies of the Pascal syntax is to make some intentional mistakes."

command should be used to debug these programs, since the C/-S command destroys the source code.

Compile and run the revised program. You may wish to experiment with different types of input. (Such as negative numbers or zeroes.)

As an exercise, add two lines to the program to multiply First and Second together and write "The product of 12 and 3 is 36." It will be necessary to add a new variable to the VAR declaration statement and to add an additional Write statement. As in BASIC, the multiplication symbol is *.

Integer Division in Pascal

Since Tiny Pascal supports only integers, division presents a special problem. In Pascal division of integers is indicated by the keyword DIV and the quotient is a truncated, not rounded, integer. Thus, 15 DIV 4 returns a quotient of 3. The slash symbol, used in Pascal for division of real numbers, cannot be used in Tiny Pascal. However, the MOD function will return the remainder of integer division. Here is a short program to illustrate how the DIV and the MOD functions work:

```
(* PASCAL INTEGER DIVISION *)
VAR FIRST, SECOND, QUO, REM: INTEGER;
BEGIN
  WRITE('THE FIRST NUMBER IS ');
  READ(FIRST#);
  WRITE('THE SECOND NUMBER IS ');
  READ(SECOND#);
  QUO := FIRST DIV SECOND;
  REM := FIRST MOD SECOND;
  WRITE('THE QUOTIENT IS ', QUO#, ' ');
  WRITE('THE REMAINDER IS ', REM#);
END.
```

For output in fractional form, replace the last two Write statements with:

```
WRITE(FIRST#, ' DIVIDED BY ', SECOND#, ' EQUALS ',
      QUO#, ' AND ', REM#, '/', FIRST#)
```

Error Codes

If you have entered the suggested programs or experimented in other ways, you have most likely been introduced to the error codes. The Tiny Pascal manual explains the code messages. There are many error messages; and they are very specific. In practice, the messages don't always describe your mistake, and occasionally quite obvious syntax errors result in no error code at all. But for the most part, they will tell you where you went wrong.

A good way to learn about the idiosyncracies of the Pascal syntax is to make some

intentional mistakes. If the variable declaration statement is retyped with an extra space after each comma, no error results. However, omitting spaces is less successful than adding extra ones. For example, if the space between the words VAR and FIRST is omitted, you'll get error number 18. If the eighth and ninth lines are retyped as follows, no error message is displayed.

```
QUO := FIRSTDIVSECOND;
REM := FIRSTMODSECOND;
```

However, the omitted spaces result in an execution error. FIRSTDIVSECOND and FIRSTMODSECOND are read by the compiler as single variables indistinguishable from the variable First.

Although extra spaces around punctuation are not necessary, they may be added as desired for program readability. Use caution when deleting spaces to make a program compact. Leave spaces around keywords, and use spaces any time ambiguity could result without them.

Omitting Begin results in error 18 (error in declaration part). In addition to being a delimiter of program statements, Begin also signals the End of the declaration statement. Omitting End results in error 14 (; expected). The compiler is looking for a delimiter to mark the end of the last program statement and cannot find it. Many errors which have no specific error message call error 14.

In Tiny Pascal, omitted words will not be implied. Although identifier names may be abbreviated to the first four letters, keywords must be typed in full.

Punctuation Errors

Be aware of punctuation, too. Omitting the period after a program's final End statement results in error 1000 (. missing). End statements are also used to mark the end of a loop or branch. An internal End statement is not followed by a period, but by a semicolon or no punctuation at all, depending on the context (see Table 1). The last program statement before an internal End statement does not require a semicolon, just as the last program statement before the final End does not.

Omitting # or % after a variable in a Read or Write statement does not cause an error message—but does cause execution errors. This kind of error is dangerous; you have no indication anything is wrong, unless the output is clearly unreasonable.

The moral of the punctuation story is

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"Since Pascal is executed so much faster than Level II BASIC, a larger number of loops must be used to achieve the desired delay."

this: Do not depend on error messages. If you are unsure of the correct punctuation, refer to the syntax diagrams in the Tiny Pascal manual.

Truth or Consequences

A Boolean statement (named after George Boole, the 19th century English mathematician) is a statement to be tested for truth. In Pascal, a true statement returns a one and a false statement returns a zero. Enter, compile and run the following program:

```
(* BOOLEAN EXPRESSIONS AND RELATIONAL
OPERATORS *)
VAR TRUE,FALSE:INTEGER;
BEGIN
  TRUE:= 4 = 4;
  FALSE:= 4 = 5;
  WRITE('A TRUE EXPRESSION HAS THE VALUE OF ',
  TRUE#13);
  WRITE('A FALSE EXPRESSION HAS THE VALUE OF ',
  FALSE#)
END.
```

In the fourth and fifth lines, $4 = 4$ and $4 = 5$ are Boolean statements. These lines illustrate the difference between the assignment symbol, $:=$, and the equality symbol, $=$. The third statement, for example, could be interpreted as: If 4 equals 4, then assign a value of 1 to the variable: True.

There are five other relational operators which may be used within a Boolean statement. All six operators are illustrated in the following sample statements:

```
X:= Y+6 > Z+2
XX:= Y+7 * Y < TOTAL
FALSE:= RIGHT=WRONG+WRONG
TEST:= BALONEY<>STEAK
WEEK:= FRIDAY>= MONDAY
NEW:= MIN<= MAX
IF THEN ELSE
```

This construction is similar to its Level II BASIC counterpart. Try the following program:

```
(* COMBINATION LOCK *)
VAR COMBNUM:INTEGER;
BEGIN
  WRITE('ENTER THE FOUR DIGIT COMBINATION THAT
  WILL OPEN THE DOOR');
  READ(COMBNUM#);
  IF COMBNUM = 2468 THEN WRITE('COME IN, THE
  DOOR IS OPEN!')
  ELSE WRITE('DUMMY, YOU ENTERED THE WRONG
  COMBINATION!')
END.
```

The argument of the IF statement is a

Boolean statement which is evaluated by Pascal as a one or a zero. The lines containing If, Then and Else together are a single Pascal statement. A semicolon after the IF...THEN line results in the ubiquitous error 14. If the instructions following the IF...THEN statement require multiple statements, the following form is used:

```
IF COMBNUM = 2468 THEN
  BEGIN
    WRITE('COME IN, THE DOOR IS OPEN!');
    ... (other statements to be executed follow) ...;
  END
ELSE
  BEGIN
    WRITE('YOU DUMMY, YOU ENTERED THE WRONG
    COMBINATION!');
    ... (other statements to be executed follow) ...;
  END
END
```

Begin and End (with no period following End) must be used to bracket the compound statements. Are you starting to see the importance of indenting program lines? The lines between each set of Begin and End statements, and those between each set of If and Else statements, should be indented. In a construction such as this one, proper indenting reveals the program logic and structure in a way that is seldom achieved in a BASIC program.

Else may be omitted in the single line form but not in the compound form. If Else is omitted, execution will fall through to the next line after the Then instruction. The word Then may not be omitted in either form.

Logical Operators

In addition to the relational operators, Pascal allows the use of the logical operators AND, OR and NOT. These may be used in IF...THEN statements and other constructions requiring Boolean statements. They are exact counterparts of the logical operators used in Level II BASIC. The following contain true statements and would all result in execution of the Write statements:

```
BEGIN
  IF (2 = 2) AND (3 = 3) THEN WRITE('BOTH STATEMENTS
  ARE TRUE.')
END.

BEGIN
  IF (2 = 2) OR (3 = 3) THEN WRITE('ONE OR BOTH OF
  THESE STATEMENTS ARE TRUE.')
END.
```

BEGIN

```
IF (2 = 2) OR (3 = 4) THEN WRITE('ONE OR BOTH OF
THESE STATEMENTS ARE TRUE.')
END.
```

```
BEGIN
  IF NOT (2 = 3) THEN WRITE('THE STATEMENT WITHIN
  PARENTHESES IS NOT TRUE.')
END.
```

Tiny Pascal does not require parentheses in the IF...THEN statements, but they are often necessary when logical operators are used because of the hierarchy of operations. Operations of the same level are performed from left to right, then operations of the next lower level are performed from left to right, etc. In Pascal, NOT is the highest level operator; *, AND, DIV and MOD share the next level; OR, + and - are the next lower order; and the relational operators are last. In the statements above, parentheses are needed to force evaluation of the equality of the expressions before the logical operations take place.

Loops: FOR-DO

The Pascal FOR-DO loop resembles the BASIC FOR-NEXT loop. The loop may be written as a single statement or combined statements. A one-line FOR-DO loop with no instruction following DO may be used to delay program execution:

```
FOR I:= 1 TO 30000 DO;
```

The index variable, I, must be declared in the VAR statement before it may be used. Since Pascal is executed so much faster than Level II BASIC, a larger number of loops must be used to achieve the desired delay. The above loop took 27 seconds to execute.

The FOR-DO construction also allows compound statements as illustrated in the following program:

```
(* FACTORIAL PROGRAM *)
VAR FACTOR,NUMBER,COUNT:INTEGER;
BEGIN
  FACTOR:= 1;
  WRITE('ENTER A NUMBER ');
  READ(NUMBER#);
  FOR COUNT:= 1 TO NUMBER DO
    BEGIN
      WRITE('THINKING. ...',13);
      FACTOR:= COUNT*FACTOR
    END;
  WRITE(NUMBER#,' FACTORIAL EQUALS ',FACTOR#)
END.
```

The TRS-80 integer range of -32767 to 32767 seriously limits the usefulness of this program, as you will find if you try to enter

*"The FOR-DO loop is used
when repetition is not dependent upon
a certain condition. If it is,
Pascal offer two kinds of loops..."*

any number larger than seven.

Note the semicolon after the End statement. The last statement before the loop End does not require a semicolon, nor does the last statement before the final End.

The index variable in a FOR-DO loop may be decremented using DOWNT0. (Increments or decrements of more than one, however, are not allowed.) Replace the seventh line with:

```
FOR COUNT:= NUMBER DOWNT0 2 DO
```

Conditional Looping

The FOR-DO loop is used when repetition is not dependent upon a certain condition. If it is, Pascal offers two kinds of loops, REPEAT UNTIL and WHILE DO. The difference between them is subtle, and in many cases either could be used. In the REPEAT UNTIL construction, the condition is tested after the statements in the loop are executed. In WHILE DO construction, the condition is tested first: If the condition is not present, execution of the instructions within the loop is avoided. Two program examples follow, one using REPEAT UNTIL, and the other using WHILE DO. The first converts a decimal number to its binary equivalent.

```
(*DECIMAL TO BINARY*)
VAR NUMBER, BINARY, QUOTIENT:INTEGER;
BEGIN
  WRITE('ENTER A NUMBER ');
  READ(NUMBER#);
  WRITE(13, 'THE BINARY REPRESENTATION OF ',
    NUMBER#, ' IS ');
  REPEAT
    QUOTIENT:= NUMBER DIV 2;
    BINARY:= NUMBER MOD 2;
    NUMBER:= QUOTIENT;
    WRITE(13, BINARY#);
  UNTIL QUOTIENT=0;
  WRITE(13, 'READ BINARY NUMBER FROM BOTTOM
    TO TOP');
END.
```

Repeat and Until form the boundaries of this loop, rather than Begin and End. Until is followed by a Boolean statement and execution of the loop continues until the statement is tested and found to be true.

In the WHILE-DO construction, the Boolean statement to be tested is placed between WHILE and DO. Begin and End (with a semicolon) are used as boundary statements. A program segment, used to compute a statistical formula containing the variable Y in the denominator, follows. Any time Y has the value of zero, execution of the formula statements is avoided and a substitute instruction is executed. The

WHILE-DO loop avoids a division-by-zero error.

```
WHILE Y<>0 DO
  BEGIN
    ABSFX:=(M1-MX)*P DIV SX*Y;
    WRITE(ABSFX#);
  END;
ELSE
  BEGIN
    ABSFX:=0;
    WRITE('ABSFX=0');
  END;
... continue with rest of program...
```

The Case for Multiple Branching

Pascal's Case statement is equivalent to BASIC's ON...GOTO. It has a variable (integer or expression) called the selector, which points to the statement to be executed. The example below shows a menu selection application of Case:

```
(*MENU SELECTOR*)
VAR CHOICE:INTEGER;
BEGIN
  WRITE('ENTER THE NUMBER OR THE ACTIVITY YOU
    HAVE SELECTED. ');
  READ(CHOICE#);
  CASE CHOICE OF
    1:BEGIN
      ... statements to be executed for choice number
      1...;
      ... end each one but the last with a semicolon...
    END;
    2:BEGIN
      ... statements to be executed for choice number
      2...;
      ... are you getting the idea now?...
    END;
    3:WRITE('YOU HAVE CHOSEN TO END THE
      PROGRAM. ');
    END;
  END.
```

The Case statement is matched by an End statement punctuated by a semicolon. Each branch has a constant, called a case label, which corresponds to a possible integer value of the Case selector variable. The branch statements may be single or multiple: If multiple, they are bounded by Begin and End (semicolon required).

It is possible to use more than one number for a single branch:

```
CASE CHOICE OF
  1,5:
  3:
  4,8:
  END;
```

If a branch does not exist for a given value of the selector, execution passes to the statement after Case End. Tiny Pascal allows an Else statement to be used with

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"One last warning... if you have loaded the P-code of a program from tape, do not try to use the edit mode."

Case. This is useful if special instructions are needed when the selector variable has a value that does not correspond to the branch numbers.

The following program is a variation of the Menu Selector Program. The menu is offered repeatedly until option three is chosen. If the user inputs a value for Choice other than 1, 2 or 3, the message "Stick to the menu!" will be printed, followed by a return to the menu.

Take special care when entering this program; the Case statement is particularly finicky about semicolons.

```
(* MENU SELECTOR II *)
VAR CHOICE, I: INTEGER;
BEGIN
  I := 1;
  REPEAT
    WRITE(13, 'ENTER THE NUMBER OF THE ACTIVITY
    YOU WANT. ');
    WRITE(13, '1—ACTIVITY FOR BEGINNERS');
    WRITE(13, '2—ACTIVITY FOR VIRTUOSOS');
    WRITE(13, '3—I DO NOT WANT ANY ACTIVITY', 13);
    READ(CHOICE#);
    CASE CHOICE OF
      1: BEGIN
        WRITE(13, 'YOU HAVE CHOSEN 1');
        WRITE(13, 'THIS IS A GOOD CHOICE FOR
        BEGINNERS. ');
      END;
      2: WRITE(13, 'YOU HAVE PICKED A TOUGH ONE. GOOD
      LUCK! ');
      3: BEGIN
        WRITE(13, 'YOU HAVE CHOSEN TO END THE
```

```
PROGRAM. ');
  I := 0;
  END
ELSE
  WRITE('STICK TO THE MENU!')
  END
UNTIL I = 0
END.
```

Saving and Loading

You may save both source file and P-code for a program written in Tiny Pascal. The commands are "WS filename" and "WP filename", to save source and object files, respectively. Loading is done with the commands "LS filename" and "LP filename". File names may not exceed six characters in length. All commands to save and load are given from the monitor mode.

There are three warnings in the Tiny Pas-

cal manual about loading and saving programs. When loading a program, you must enter the file name *exactly* as it was saved on tape. Warning number two is that there is no way to read the names of files on tape: If you forgot the file name you cannot retrieve the program.

The third warning in the user's manual is to use care not to get the source file and the object code mixed up when loading from tape. If you try to load the P-code, for example, with the command "LS filename", you will have to reload the entire system.

One last warning, this one my own. If you have loaded the P-code of a program from tape, do not try to use the edit mode. Leaving the monitor will result in the loss of your program, and it will have to be reloaded from tape. ■

Construction

Entire Program
IF THEN ELSE
FOR DO
REPEAT UNTIL
WHILE DO
CASE
CASE BRANCHES

Statement Delimiters

BEGIN END.
BEGIN END
BEGIN END:
REPEAT UNTIL...;
BEGIN END;
CASE... END
BEGIN END; *

*Omit semicolon at end of last branch before Else or End.

Table 1. Summary of Multiple Statement Delimiters



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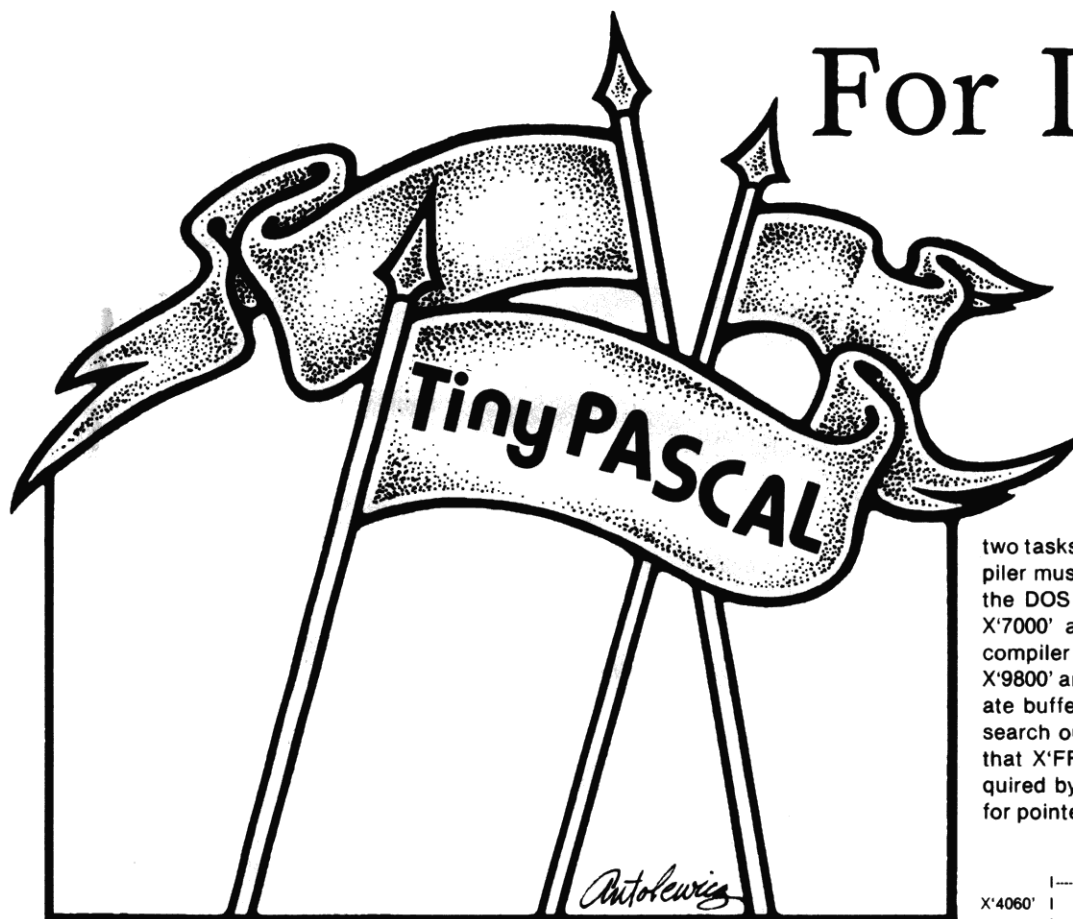
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Modify Tiny Pascal For Disk



Lt. John B. Harrell
30 KeKlico Court West
Charleston, SC 29408

Radio Shack has released a tape-based Tiny Pascal compiler for both 16K and 32K+ system users. I intend to show users of 32K+ disk-based systems how to make this compiler run from the disk using disk input and output of source files. The article also shows that compiled code can be stored and loaded from the disk.

The Tiny Pascal system is a complete, self-contained operating system, consisting of a monitor, interpreter, compiler and editor. The monitor operates the entire system, and, additionally, saves and loads source and object programs to the cassette recorder. Output from the compiler is a compressed three-byte P-code. Normally,

all these subsystems reside in memory simultaneously, but you do have the option of overwriting the compiler or editor for extra space. I have never found this necessary on my 32K system.

The text editor is adequate for creation of source programs, but has severe limitations on the amount of text editing that you can perform. You can insert, delete or replace entire lines. To overcome this restriction, I have modified the compiler to look for an ASCII text file that has been previously loaded into RAM storage, starting at address X'9800' to the end of memory. This is done by terminating the text file with an X'FF' byte as an end-of-file mark. (This is consistent with the end-of-file mark used by the compiler, but it would be easy to use Electric Pencil to create a file and then change the Pencil X'00' EOF to X'FF'.)

Modifying Tiny Pascal

To modify the compiler to run from disk,

two tasks must be accomplished. The compiler must first be moved up to load above the DOS system requirements (I selected X'7000' as my load point). Secondly, the compiler must be modified to start at X'9800' and move text down to the appropriate buffer at X'73F0' (Fig. 1). It must then search out the end of text file (Remember that X'FF' byte?) and set the pointers required by the compiler system. See Fig. 2 for pointers that must be set.

X'4060'	reserved RAM for interpreter & monitor
X'4100'	entry points table
X'4180'	system control block
X'41A0'	I/O routines
X'41E0'	interpreter and run time routines
X'473A'	monitor
X'4990'	run time stack for editor or compiler (3-1/4 K)
X'5690'	editor P-code
X'5EA0'	compiler table
X'5FC0'	compiler P-code
X'73F0'	user memory for source and P-code

Fig. 1. Memory Map for the 32K+ Tiny Pascal System

"The Tiny Pascal system is a complete, self-contained operating system, consisting of a monitor/interpreter, compiler and editor."

To make the modification, type in Program Listing 1 using the Editor/Assembler, assemble it and write a system tape. You have now created the patch to the Tiny Pascal system, and all you must do to run it from the disk is load the Tiny Pascal system tape, 32K version (PAS32K), under normal Level II load procedures. To enter Level II, you must use the DOS BASIC2, or push reset while holding down the Break key. Then load the patch tape, execute it, and follow the instructions on the video screen. When it exits to the DOS reboot, dump the modified compiler system to disk using the address parameters displayed on the video.

Program Listings 2 and 3 are used to load a source file to memory and execute the compiler, and to save source files to the disk.

Listing 1 modifies the Tiny Pascal system in two parts. First, by moving the system from its resident area on loading (X'4D90' to X'73C6') to the area of RAM starting at address X'7000' and ending at X'9636'. And then it links the high RAM source code block move to the initialization phase of the compiler.

Lines 9-12 clear the screen and issue the prompt. Pressing any key will finish the patch. Lines 13-16 move Tiny Pascal to its new resident area. Lines 17-18 patch the source code block move into the compiler initialization phase. Lines 20-22 display the "done" message, wait for any key to be pressed and then reboot so the code can be loaded to the disk.

The rest of the patch code is ORGed to load in X'9637' following the moved compiler code. The initial phase of this code is identical to the power-up reset on the ROM chip, and is necessary because the compiler expects to be run in a Level II environment and not under the TRSDOS initialization of RAM areas X'4000' to X'40C0'. (This is lines 27-43 in the patch program). Lines 47-50 move the compiler from its disk load address to its normal load point at X'4D90'.

To clear the way for the source code to be

ADDRESS	FUNCTION
4180	Starting address of source code
4182	Ending address of source code
4184	Starting address of P-code
4186	Ending address of P-code
418C	Also contains starting address of source code
4196	Address of program currently in execution

All addresses are in hexadecimal

```

00001 ;*****
00002 ;*
00003 ;*          TINY PASCAL DISK MCD
00004 ;*
00005 ;*          PROGRAM LISTING #1
00006 ;*
00007 ;*          WRITTEN BY JOHN B. HARRELL
00008 ;*          12/05/80
00009 ;*
00010 ;*****

00011
00012
00013 FASMOD  ORG      0E000H
00014 LD      SP,$
00015 CALL    CLS          ;CLEAR SCREEN
00016 LD      HL,MS1
00017 CALL    OUTSTR       ;START PROMPT
00018 LD      HL,73C6H     ;END OF 32K PASCAL SYS
00019 LD      DE,9636H     ;WHERE IT WILL END
00020 LD      BC,2637H     ;BYTE COUNT
00021 LDIR                     ;MOVE IT OUT OF DOS
00022 LD      HL,MOVEIT
00023 LD      (700CH),HL    ;PATCH ADDR IN PAS32K
00024 LD      HL,MS2
00025 CALL    OUTSTR       ;END AND DONE
00026 CALL    INKEY
00027 JP      0            ;REBOOT DOS
00028

00029 ;          CODE PATCH FOR PAS32K
00030
00031 ORG      9637H         ;PATCH ADDRESS
00032 DI
00033 XOR      A
00034 PATCH1 LD      HL,06D2H
00035 LD      DE,4000H
00036 LD      BC,36H
00037 LDIR                     ;RE-WRITE LEVEL-II
00038 DEC      A           ;VECTOR AREA
00039 DEC      A           ;JUST LIKE ON A
00040 JR      NZ,PATCH1    ;POWER-UP RESET
00041 LD      LD      (DE),A ;ZERO 39 BYTES
00042 PATCH2 INC      DE
00043 DJNZ     PATCH2
00044 LD      DE,4080H
00045 LD      HL,18F7H
00046 LD      BC,27H
00047 LDIR
00048
00049
00050 ;          END OF POWER-UP ROUTINE

00051
00052 LD      HL,7000H
00053 LD      DE,4D90H
00054 LD      BC,2637H
00055 LDIR                     ;MOVE PAS32K BACK
00056
00057 ;          MOVE NEXT BLOCK TO HIGH CORE
00058
00059 LD      HL,START
00060 LD      DE,0C000H-END+START-1
00061 LD      BC,END-START+1
00062 LDIR
00063

00064 ;          EXECUTE COMPILER
00065
00066 JP      4D90H

00067
00068 ;          COMPILER WILL LINK TO THE ROUTINE IN HIGH
00069 ;          MEMORY TO MOVE SOURCE PROGRAM DOWN TO BUFFER
00070

00071 START LD      HL,9800H   ;START OF BASIC BUFFER
00072 LD      DE,73F0H       ;START OF PASCAL BUFFER
00073 LD      BC,2800H       ;BUFFER LENGTH
00074 LDIR

```

Program continues

Fig. 2. Addresses Used to Patch the Tiny Pascal System

"Normally, all these subsystems reside . . . simultaneously, but you do have the option of overwriting . . . I have never found this necessary."

placed in its proper buffer, a small segment of code in lines 54-57 moves the source code loader to high memory where it will be out of the way. The last step is to execute the compiler, which will, in turn, move the system segments around and execute the source code loader prior to displaying the user prompt.

The last part of the patch program is the segment from line 66 to line 81. This portion of code moves the source code file from its load address (X'9800') to the respective buffer address (X'73F0'—Fig. 1) using a block move. Pointers are set to the starting address of the source code, and a block compare is executed to find the X'FF' end of file byte in the source code. On exit from the block compare, register HL contains the end of source code + 1, the start of the compiled P-code. Pointers are set for this and for the end of source code, and the compiler is executed. Reference Fig. 2 for pointers to set.

"I have found Tiny Pascal . . . an exciting, . . . powerful language"

The following changes to Listing 1 will enhance the operation of a 48K system and allow larger files to be used. Change the byte count in line 68 from X'2800' to X'6800'. Change the byte count in line 87 to read 0BFD5H vice 0BFD5H for the label MOVEIT. Change the address part of line 55 from 0C000H- . . . to 0- . . .

Loading and Saving Source Files

Program Listings 2 and 3 are the mechanism through which source files are loaded and saved using disks. Enter both programs and save them under appropriate names. Pascal programs can now be loaded and saved.

Listing 2 loads a Pascal file from disk and calls Tiny Pascal. Line 1 protects memory above X'9800' and clears string space for the disk file to be loaded to a string array. You are requested to enter a filespec for the Pascal source file. If no file name is entered, the buffer is immediately terminated by the X'FF' end-of-file byte, and the compiler is called.

If the file is successfully opened, it is read line by line into a string array, terminat-

```

967D 3EFF 00075 LD A,0FFH ;TERMINATOR CHAR
967F 21F073 00076 LD HL,73F0H
9682 010028 00077 LD BC,2806H
9685 228041 00078 LD (4180H),HL ;PROGRAM START
9688 228C41 00079 LD (418CH),HL ;SAME
968E EDB1 00080 CPIR ;FIND TERMINATOR
968D 228441 00081 LD (4184H),HL ;START OF P-CODE
9690 228641 00082 LD (4186H),HL ;END OF P-CODE
9693 229641 00083 LD (4196H),HL ;ADDR OF CURRENT PGM
9696 28 00084 DEC HL ;POINT TO END OF SOURCE
9697 228241 00085 LD (4182H),HL ;END OF SOURCE
969A C33A47 00086 JP 473AH ;EXECUTE TINY PASCAL
969C 00087 END EQU $-1

01C9 00088 EQU 81C9H ;CLEAR SCREEN
0049 00089 INKEY EQU 0049H ;WAIT FOR KEY
28A7 00090 OUTSTR EQU 28A7H ;OUTPUT STRING
BFD5 00092 MOVEIT EQU 0BFD5H ;SOURCE MOVER

969D 00 00094 MS1 DEFB 13
969E 00 00095 DEFB 13
969F 49 00096 DEFB 'IF YOU HAVE LOADED TINY PASCAL <PAS32K>'

46 20 59 4F 55 20 48 41
56 45 20 4C 4F 41 44 45
44 20 54 49 4E 59 20 50
41 53 43 41 4C 20 3C 50
41 53 33 32 4B 3E

96C6 00 00097 DEFB 13
96C7 56 00098 DEFB 'VERSION, PRESS ANY KEY---'

45 52 53 49 4F 4E 2C 20
50 52 45 53 53 20 41 4E
59 20 4B 45 59 2D 2D 2D

96E0 00 00099 DEFB 13
96E1 4F 00100 DEFB 'OTHERWISE, HIT RESET AND LOAD IT'

54 48 45 52 57 49 53 45
2C 20 4B 49 54 20 52 45
53 45 54 20 41 4E 44 20
4C 4F 41 44 20 49 54

9701 00 00101 DEFB 0
9702 000D 00102 MS2 DEFB 000DH
9704 49 00103 DEFB 'I HAVE FINISHED THE MODIFICATION.'

20 48 41 56 45 20 46 49
4E 49 53 4B 45 44 20 54
4B 45 20 4D 4F 44 49 46
49 43 41 54 49 4F 4E 2E

9725 8D 00104 DEFB 13
9726 50 00105 DEFB 'PRESS ANY KEY TO RE-BOOT DOS AND USE'

52 45 53 53 20 41 4E 59
20 4B 45 59 20 54 4F 20
52 45 20 42 4F 4F 54 20
44 4F 53 20 41 4E 44 20
55 53 45

974A 00 00106 DEFB 13
974B 54 00107 DEFB 'THE DOS <DUMP> COMMAND TO PUT IT ON DISK'

48 45 20 44 4F 53 20 3C
44 55 4D 50 3E 20 43 4F
4D 4D 41 4E 44 20 54 4F
20 50 55 54 20 49 54 20
4F 4E 20 44 49 53 4B

9773 0D 00108 DEFB 13
9774 55 00109 DEFB 'UNDER THE NAME OF <PAS32K/CMD> WITH'

4E 44 45 52 20 54 4B 45
20 4E 41 4D 45 20 4F 46
20 3C 50 41 53 33 32 4B
2F 43 4D 44 3E 20 57 49
54 48

9797 8D 00110 DEFB 13
9798 54 00111 DEFB 'THE FOLLOWING PARAMETERS FOR THE DUMP'

48 45 20 46 4F 4C 4C 4F
57 49 4E 47 20 50 41 52
41 4D 45 54 45 52 53 20
46 4F 52 20 54 4B 45 20
44 55 4D 50

97BD 0D 00112 DEFB 13
97BE 53 00113 DEFB 'START=7000H, END=969CH, TRA=9637H'

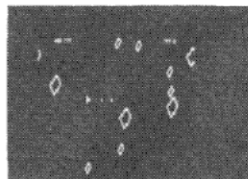
54 41 52 54 3D 37 30 30
30 4B 2C 20 45 4E 44 3D
39 36 39 43 4B 2C 20 54
52 41 3D 39 36 33 37 4B

97DF 00 00114 DEFB 0
0000 00115
00008 TOTAL ERRORS 00116 END PASM0D

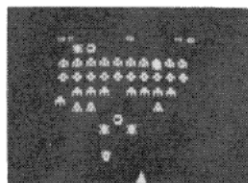
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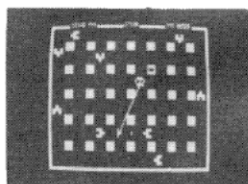
SUPER NOVA[©]



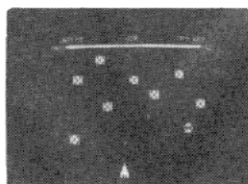
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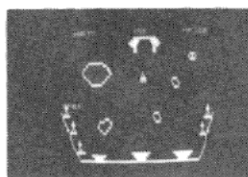
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"The text editor is adequate for creation of source programs, but has severe limitations on the amount of text editing that you can perform."

```
1 POKE &H40B1,&HFF:POKE &H40B2,&H97:CLR9900:CLS
2 DEFINT A-Z:AD=&H9800:DIM A$(500)
3 PRINT TAB(14)"** TINY * PASCAL ** FILE LOADER":PRINT
4 LINEINPUT"ENTER FILESPEX FOR SOURCE FILE: ";FS$
5 IF FS$="" THEN 19
6 ON ERROR GOTO 22
7 OPEN "I",1,FS$:ON ERROR GOTO 0
8 PRINT"LOADING *** "FS$ *** FROM DISK
9 PRINT:LN=0
10 LINEINPUT$1, L$
11 IF LEFT$(L$,1)<>CHR$(255) THEN LN=LN+1:A$(LN)=L$:GOTO 10
12 CLOSE
13 FOR I=1 TO LN
14 PRINT A$(I)
15 FOR J=1 TO LEN(A$(I))
16 POKE AD,ASC(MID$(A$(I),J,1))
17 AD=AD+1:NEXT:POKE AD,13:AD=AD+1
18 NEXT
19 POKE AD,255:POKE AD+1,255
20 CLEAR 50
21 CMD"PAS32K"
22 CMD"E":RESUME 4
```

Program Listing 2

```
1 POKE &H40B1,&HEF:POKE &H40B2,&H73:CLR 500:CLS:DEFINT A-Z
2 PRINT TAB(16)"** TINY * PASCAL ** FILE SAVER"
3 PRINT
4 LINE INPUT"ENTER FILESPEX FOR PASCAL FILE: ";FS$
5 IF FS$="" THEN 4
6 ON ERROR GOTO 15
7 OPEN"O",1,FS$:ON ERROR GOTO 0
8 AD=&H73F0
9 A$=""
10 J=PEEK(AD):IF J=255 THEN 14
11 AD=AD+1:IF J=13 THEN 13
12 A$=A$+CHR$(J):GOTO 10
13 PRINT$1,A$:PRINT A$:GOTO 9
14 PRINT$1,CHR$(255):CHR$(255):CLOSE:POKE&H40B1,&HFF:
POKE&H40B2,&HBF:CLR50:END
15 CMD"E":RESUME 4
```

Program Listing 3

Breakout Program

Footnote to IF MEM lines following PROC PADDLE; these lines should read as follows:

IF MEM (KEYBD)= 32 THEN (* USE← TO MOVE PADDLE LEFT*)

IF MEM (KEYBD)= 64 THEN (* USE→ TO MOVE PADDLE RIGHT*)

```
CONST CURSOR=X4020; VIDEO=X3C00; KEYBD=X3B40:
```

```
VAR A,B,SPEED,XPOS,YPOS,PPQS,XDIR,YDIR,SCORE,SPVAR:INTEGER;
K,STOP,BEST,NB,I,FLAG,TEMP,NBP:INTEGER;
```

```
FUNC RAND(N);
```

```
VAR TEMP:INTEGER;
```

```
BEGIN
```

```
TEMP:=(A+B) AND %007F; A:=B; B:=TEMP;
```

```
RAND:=((N*TEMP) DIV 128)+1 END;
```

```
PROC PTC(LINE,POS);
```

```
VAR TEMP:INTEGER;
```

```
BEGIN MEMW(CURSOR):=VIDEO+64*LINE+POS END;
```

Program continues

"Hitting the ball... causes varying amounts of backspin... losing the ball will get you a raspberry over the audio amplifier."

ing on the X'FF' byte. After closing the file, it is listed to the video and copied byte by byte into the buffer beginning at X'9800'. When this is finished, the compiler is called.

NEWDOS users may use Program Listings 2 and 3 as is. TRSDOS users will have to substitute <CMD"1", "PAS32K"> in line 21 for <CMD"PAS32K">.

To save a Pascal source file, press reset when you have completed all operations requiring Tiny Pascal. After reboot, run the BASIC file saver. The text buffer is still intact in RAM beginning at X'73F0', and memory size will be set automatically to protect the area above X'73EF'. Enter a filespec to begin copying the file to disk and video. The disk file is ended by X'FFFF0D', and memory size is returned to full memory.

A Demonstration Pascal Program

Breakout (Program Listing 4) is an arcade game written in Tiny Pascal, and based totally on a program written in MMSFORTH by A. Shaeffer, published in Byte magazine, August, 1980, in an article by A. Richard and Jill Miller. This game is perfectly structured for Pascal and is a good example of the relative speed difference between Pascal and BASIC.

Pascal is a one-pass compiler requiring all variables, procedures, etc. to be defined prior to their use. The program, therefore, is a top-down design, bottom-up structure. A study of the MMSFORTH version shows quite a few primitives defined that are useful for the TRS-80.

The rules of Breakout are simple: Select the speed you want and the number of balls. As the ball hits more blocks in the wall, it moves higher and higher up the screen, gathering speed. The paddle is controlled by the right and left arrow keys.

If you are fortunate enough to chip away the entire wall, the screen will fill again, letting you play all of your balls. If you have sound hooked to your cassette port, you will hear a beep every time the ball collides with any white object on the screen. Hitting the ball with various portions of the paddle causes varying amounts of backspin to be put on the ball. Losing the ball will get you a raspberry over the audio amplifier.

The Game in Detail

The first function, RAND, returns a random number which is in the range of 1 to N. The method used is a Fibonacci series generator. This generator is seeded to start from the same initial value each time, and could be changed to randomize itself. In this particular function, N should be limited

```
PROC LINE(NUMBER);
BEGIN PTC(NUMBER,0); WRITE(30) END;

PROC BOP;
VAR I:INTEGER;
BEGIN
  FOR I:=1 TO 10 DO BEGIN OUTP(255,1); OUTP(255,2) END END;

PROC FILL(START,COUNT,CHAR);
VAR I:INTEGER;
BEGIN FOR I:= START TO START+COUNT-1 DO MEM(I):=CHAR END;

PROC PCLR;
BEGIN FILL(16320+PPOS,8,32) END;

PROC PSET;
BEGIN FILL(16320+PPOS,8,176) END;

FUNC MIN(A,B);
BEGIN IF A>B THEN MIN:=B ELSE MIN:=A END;

FUNC MAX(A,B);
BEGIN IF A>B THEN MAX:=A ELSE MAX:=B END;

PROC PADDLE;
BEGIN
  IF MEM(KEYBD)=32 THEN (* USE 'J' TO MOVE PADDLE LEFT *)
  BEGIN PCLR; PPOS:=MAX(2,PPOS-1); PSET END;
  IF MEM(KEYBD)=64 THEN (* USE 'K' TO MOVE PADDLE RIGHT *)
  BEGIN PCLR; PPOS:=MIN(54,PPOS+1); PSET END END;

PROC DSET(X,Y);
BEGIN PLOT(X+X,Y,1); PLOT(X+X+1,Y,1) END;

PROC DCLR(X,Y);
BEGIN PLOT(X+X,Y,0); PLOT(X+X+1,Y,0) END;

FUNC DTEST(X,Y);
BEGIN
  IF POINT(X+X,Y) AND POINT(X+X+1,Y) THEN DTEST:=1
  ELSE DTEST:=0 END;

PROC XCHK;
BEGIN
  IF XPOS<2 THEN
  BEGIN XDIR:=-XDIR; XPOS:=2; BOP END;
  IF XPOS>61 THEN
  BEGIN XDIR:=-XDIR; XPOS:=61; BOP END END;

PROC YCHK;
BEGIN
  IF YPOS<5 THEN
  BEGIN YDIR:=1; YPOS:=5; SPVAR:=1; BOP END;
  IF YPOS<23 THEN SPVAR:=MIN(SPVAR,4);
  IF YPOS<19 THEN SPVAR:=MIN(SPVAR,3);
  IF YPOS<15 THEN SPVAR:=MIN(SPVAR,2) END;

PROC PCHK;
VAR TEMP:INTEGER;
BEGIN
  FLAG:=0;
  IF YPOS>=47 THEN BEGIN
    YPOS:=46; TEMP:=XPOS-PPOS;
    IF (TEMP>=0) AND (TEMP<8) THEN BEGIN
      YDIR:=-1; BOP;
      CASE TEMP OF
        0: XDIR:=-2; 4: XDIR:=1;
        1: XDIR:=-1; 5: XDIR:=1;
        2: XDIR:=-1; 6: XDIR:=1;
        3: XDIR:=-1; 7: XDIR:=2 END END
      ELSE FLAG:=1 END END;

PROC INIT;
VAR I:INTEGER;
```

Program continues

"...it is...a nice experimental compiler system. Even the casual experimenter can get his feet wet in this language."

to a value less than 128 for best results.

Procedures PTC and LINE are screen-control procedures. PTC sets the screen cursor to the value corresponding to the line number and character position it receives as parameters. LINE has one parameter—the line number. The cursor is set to the line number and that line is cleared.

BOP is the sound generator. Calling BOP causes the two low order bits of the cassette port to toggle, generating sound. A single call to BOP is used when the ball hits something, and a multiple call produces the raspberry noise when a ball is lost.

FILL is used to fill a block of screen RAM with a number from the selected character code. This procedure is used by PSET and PCLR to turn the paddle on the screen on and off.

PADDLE scans keyboard memory-mapped row X'3840' to determine whether the right and left arrow keys are being pressed. When a key is depressed, the paddle is cleared (PCLR), the paddle position is incremented or decremented while checking for screen limits, and the paddle is then set (PSET).

DSET, DCLR and DTEST are used to perform double-width graphics using the built-in functions of PLOT and POINT. A double graphic point defined by (X,Y) is set at the TRS-80 screen coordinates of (2*X,Y) and (2*X+1,Y).

XCHK, YCHK, and PCHK check the ball to see if it remained on-screen. XCHK reverses the X-direction and causes a BOP. YCHK checks the ball position and sets its speed according to its height inside the wall. If the ball hits the top screen border, it is reflected down at maximum speed with a BOP. PCHK checks to see if the ball should have or did hit the paddle. A flag is set to signify loss of the ball. If the ball hits the paddle, you get a BOP and the CASE statement is used to select the correct backspin.

CLR clears one block, adds up your score, gives it a BOP, and reflects the ball. CHKBALL increments the ball position and checks to see if the ball has hit anything. BALL uses CHKBALL to move the ball after clearing it, and resets the ball if it was not lost. CHKGAME checks if the wall is entirely gone. (The modulus of the score with 1800 will equal zero when the wall is gone.)

I have found Tiny Pascal to be an exciting, exceptionally powerful language. I realize much of the language isn't included in this very limited subset, but it is still a nice experimental compiler system. The price allows even the casual experimenter to "get his feet wet" in this language. ■

```
BEGIN
  WRITE(28,31,15); (* CLEAR SCREEN, HOME CURSOR *)
  PTC(3,22); WRITE('< B R E A K O U T >');
  LINE(10); WRITE('SPEED (1-10, 1 IS FASTEST) ');
  READ(SPEED); SPEED := MIN(MAX(SPEED,1),10);
  LINE(12); WRITE('NUMBER OF BALLS (1-50) ');
  READ(NB); NB:=MIN(50,MAX(1,NB));
  WRITE(28,31,15);
  FOR I:=0 TO 63 DO BEGIN DSET(I,3); DSET(I,4) END;
  FOR I:=3 TO 47 DO BEGIN
    DSET(0,I); DSET(1,I); DSET(62,I); DSET(63,I) END;
  FILL(15616,320,191); SCORE:=0; LINE(0);
  WRITE('BREAKOUT SCORE: 0 BEST: ');
  WRITE(BEST); PTC(0,54); WRITE('BALL: ') END;

PROC CLR;
VAR I,TEMP:INTEGER;
BEGIN
  TEMP:=(XPOS-2) AND 124)+2;
  FOR I:=TEMP TO TEMP+3 DO DCLR(I,YPOS);
  SCORE := SCORE + ABS(YPOS-27);
  PTC(0,34); WRITE(SCORE); BOP;
  YDIR := -YDIR END;

PROC CHKBALL;
BEGIN
  YPOS := YPOS + YDIR; XPOS := XPOS + XDIR;
  XCHK; YCHK; PCHK;
  IF DTEST(XPOS,YPOS) THEN CLR END;

PROC BALL;
BEGIN
  DCLR(XPOS,YPOS); CHKBALL;
  IF NOT FLAG THEN DSET(XPOS,YPOS) END;

PROC CHKGAME; (* CHECKS THE STATUS OF THE WALL AND GIVES
YOU A SURPRISE IF ALL GONE *)
BEGIN IF (SCORE MOD 1800)=0 THEN FILL(15616,320,191) END;

PROC DELAY;
VAR I:INTEGER;
BEGIN FOR I:= 0 TO SPVAR*SPEED DO (* NOTHING *) END;

BEGIN (* MAIN ROUTINE OF "BREAKOUT" *)

STOP:=0; BEST:=0;
A:=55; B:=89; (* SEED RANDOM NUMBER GENERATOR *)

REPEAT
  PPOS:=28; SPVAR:=0; INIT; PSET;
  FOR NBP:=1 TO NB DO BEGIN (* PLAY THE GAME *)
    FOR K:=1 TO (200 DIV SPEED) DO BEGIN DELAY; PADDLE END;
    PTC(0,61); WRITE(NBP);
    SPVAR:=5; (*SLOW IT WAY DOWN UNTIL BLOCK IS HIT*)
    IF RAND(2)=1 THEN XDIR:=1 ELSE XDIR:=-1;
    YDIR:=1; YPOS:=29;
    XPOS:=RAND(58)+2;
    REPEAT
      FOR K:=1 TO 3 DO PADDLE;
      BALL;
      CHKGAME;
      DELAY
    UNTIL FLAG;
    FOR K:=1 TO 12 DO BOP
  END (* OF THIS GAME, TEST FOR MORE *);
  BEST := MAX(BEST,SCORE);
  PTC(8,18); WRITE(' RUN GAME AGAIN? ');
  REPEAT K:=INKEY UNTIL (K='Y') OR (K='N');
  IF K='Y' THEN STOP:=0 ELSE STOP:=1
UNTIL STOP

END (* OF BREAKOUT *).
```

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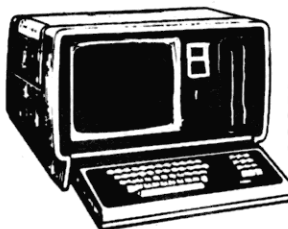
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Pros and cons of this unconventional, stack oriented language.

A First Look at FORTH

John Krutch
P.O. Box 761
Crescent City, CA 95531

FORTH is an interesting and highly unconventional computer language that seems to be gaining a great deal of use. Its creator, Charles H. Moore, initially used it to control telescope equipment at Kitt Peak National Observatory in Arizona. Moore went on to found FORTH, Inc., which develops application programs and puts the language in new computers. FORTH has been used on the 6800, 6809, 8080, Z-80, 1802, 6502, and other microcomputers.

System Structure

A FORTH system includes a compiler and an interpreter. The compiler translates FORTH source code into intermediate code, which is a series of subroutine calls. The interpreter executes the intermediate code.

The subroutines of the intermediate code form a "dictionary" that occupies a major portion of the FORTH system. Each dictionary entry, or subroutine, is named by a word.

FORTH programming builds sequences of words. The following are examples of words supplied with the system:

```

+
(
!
@
DUP
;CODE
CONSTANT

```

FORTH's nicest feature is that it allows you to create new words for new functions. New words are defined from predefined words. Once defined, a new word is added to the dictionary, and treated like a system-supplied word. New words are available for immediate execution or can be used to define other words.

FORTH also supports structured programming. In fact, for every control structure in Pascal, FORTH contains an equivalent structure.

For example, there is an If...Else...Then structure which is very similar to Pascal's If...Then...Else. The Ncase...Casend construct is close to Pascal's Case...Of. Do...Loop is equivalent to Pascal's For...To...Do. While...Perform...Pend (Begin...While...Repeat or Begin...If...While in some versions of FORTH) is equivalent to Pascal's While...Do. And Begin...End is equivalent to the Pascal Repeat...Until. There is no GOTO in the language, nor does there seem to be a need for one.

The Stack

Programming in FORTH depends on a last-in, first-out stack, called the "parameter stack." Any number given to the system is placed on top of the parameter stack. The stack grows toward low memory.

If you type: 3 <enter>, where enter indicates a carriage return, 3 will be put on top of the stack. This process is illustrated in Fig. 1.

If you now type: 7 <enter>, 7 is placed on top of the stack (Fig. 2).

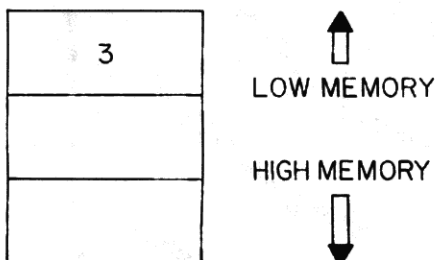


Fig. 1

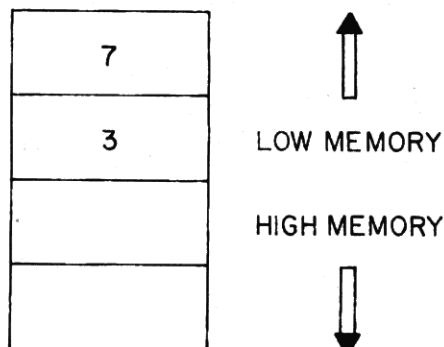


Fig. 2

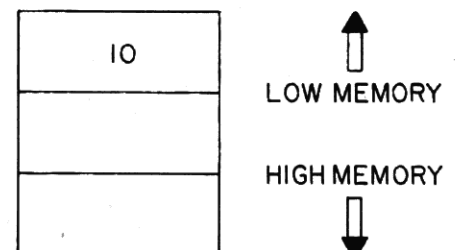


Fig. 3

"FORTH is an interesting and highly conventional computer language that seems to be gaining a great deal of use."

The FORTH word, +, takes the top two numbers on the stack, adds them together, and replaces them with the new value. If you now type: + <enter>, 10 is at the top of the stack, while 7 and 3 disappear (see Fig. 3).

At this point if you enter: <enter>, the top item of the stack is printed on the video. The stack is now empty.

Typing in items one at a time, followed by a carriage return, is not the only way to execute FORTH words. Entering the following sequence all at once would have the same effects: 3 7 + .

Let's examine more FORTH words. ECHO takes the number off the top of the stack and prints the ASCII character it represents; it performs exactly the same operation as the BASIC statement Print CHR\$. If you enter: 65 ECHO, FORTH returns A, since 65 is the ASCII code for A. If you type: 48 56 90 ECHO ECHO ECHO <enter>, then Z-80 is printed.

Move copies a block of memory from one location to another. You specify how many bytes are to be copied, where the copying is to begin, and which block of memory locations will receive the copied bytes. The address where copying begins must be in the third-from-top position of the stack. The address of the first memory location to receive the copied bytes must be second from top. The number of bytes to be copied must be on top of the stack.

The TRS-80's memory-mapped video provides a way to watch Move working. If there is something besides empty space on the top line of the display, then: 15360 15808 Move <enter> will cause the entire top line of the display to be copied to a line near the middle of the display. (15360 is the top line's beginning address in video memory; 15808

is the middle line's beginning address in video memory; 64 is the number of bytes in one line and also the number of bytes to be moved.)

Decimal to Hex

FORTH switches easily from decimal to hexadecimal to octal arithmetic. The system starts up in decimal; the word Hex switches it to hexadecimal, and Decimal returns the system to base 10. Here's an example:

```
HEX 21 3C00 400 FILL DECIMAL <enter>
```

Hex puts the system in hexadecimal mode. The numbers 21,3C00, and 400 are put on the stack with 400 on top. Fill takes the third-from-top number (which must be one byte) and fills memory locations beginning with the second-from-top address with this byte. The number of locations filled is determined by the number on the top of the stack. The third-from-top number is hexadecimal 21, which is an ASCII exclamation point. The second-from-top number is hexadecimal 3C00, which is the first location of the video RAM. The top-of-stack number is hexadecimal 400 (decimal 1024). The word Fill causes the screen to fill with exclamation points. Decimal puts the system back in decimal mode.

Want a different radix, say, base 2? It's simple. The current radix is stored in the variable Base. The FORTH word C! (pronounced C-store) can be used to store a new radix in Base.

Suppose you want to see what the decimal number 1745 looks like in binary. Type: 1745 2 BASE C! . <enter>. 1745 is put on the stack, and 2 is put on top of it. Base puts the address of variable Base on the stack. C! puts the second-from-top number into the variable whose address is

on the top of the stack; Variable Base now contains the radix 2. C! also removes from the stack both the address and the number that was put into the variable at that address, so 1745 is now on the top of the stack. The word "." prints the top-of-stack number. Since the system is now operating in base 2, the binary equivalent of 1745 is printed: 11011010001. The system will remain in base 2 until you type: DECIMAL <enter>.

New Words

To define a new word, use a colon to begin the definition and a semicolon to end it. For instance, to define the word Square, which takes the top-of-stack number and returns its square, you could do this:

```
: SQUARE DUP * . ; <enter>
```

Square is the name of the new word. DUP causes the top-of-stack item to be duplicated; * multiplies the two top stack items together and places the result on top of the stack. The period prints the top-of-stack item on the display. The line is compiled instantly when you press the carriage return, which means that the word Square and its definition are placed in the dictionary and may be used like any other FORTH word.

If you enter 14 Square, the number 14 will be put on top of the stack, and the newly-defined word Square takes over and 196 is returned. Square always requires the number which will be squared to be on the top of the stack.

Creating a Source Program

In FORTH, a source program is stored as a series of contiguous screens or blocks. Each block is 1024 bytes (1K) long. This format is perfectly suited to the TRS-80 Models I and III, whose display can hold exactly 1024 bytes of character information, 16 rows by 64 columns. A FORTH block fills the TRS-80 display.

The Program Listing is a FORTH program which occupies one block. Line 0 is a comment line; anything within parentheses is ignored by the compiler. The program inputs a string from the keyboard; when enter is pressed, the string is printed on the screen backward.

Two procedures, GetCharacters and PopandPrint, are called by the main program and result in backward strings. GetCharacters marks the bottom of the stack by putting a negative number on it, then inputs whatever characters are typed and puts their ASCII codes on the stack. PopandPrint pops each code off the stack and prints it,

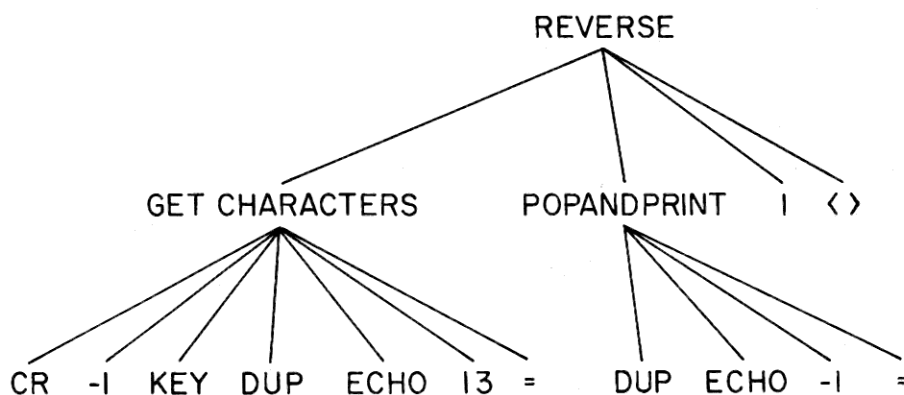
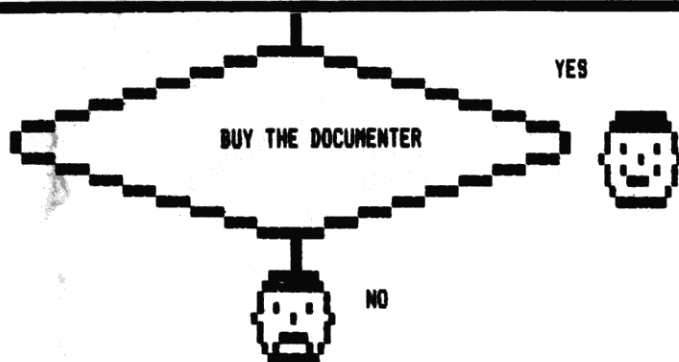


Fig. 4



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"Though basic FORTH is fairly large... when you finish writing and compiling... you can strip away portions you don't need."

stopping when the end-of-stack marker (- 1) is reached.

Since we're dealing with a LIFO (Last In, First Out) stack, the character codes are printed in reverse order from that in which they were typed. This is the reason for backward strings. The word Reverse causes GetCharacters and PopandPrint to be continually executed.

Once the block has been loaded and compiled, all you need do is type Reverse to begin execution. Reverse is defined in terms of GetCharacters and PopandPrint, which in turn are defined in terms of other words (see Fig. 4).

FORTH, Pro and Con

FORTH has a number of things going for it. Each implementation of FORTH is closely tailored to the hardware on which it's implemented. Programmers have nearly as much control over the computer as they would with assembly language. FORTH's modular, block-by-block programming style makes debugging easy, since each word can be tested and debugged as it is written. Because FORTH is implemented by a technique called "threaded code," it runs 10-20 times faster than an equivalent interpreted BASIC program.

Though basic FORTH is fairly large (mine occupies more than 10K), when you finish writing and compiling your program you can strip away portions you don't need, leaving perhaps 1K in memory at run-time.

On the other hand, there are disadvantages. Almost every individual operation in FORTH requires some sort of stack manipulation: A number is put on top of the stack, taken off the top, duplicated, swapped with the number above or below it, etc. This extensive manipulation of the stack leads to what is perhaps FORTH's greatest defect.

FORTH source programs (which are usually much longer and more involved than the Program Listing included here) are hard to read, and can be hard to write. There are so many stack manipulations during the course of a FORTH program that it's a difficult and puzzling task to keep track of them all.

There are more versions of FORTH for the TRS-80 available than any other language except BASIC. I use the system supplied by Miller Microcomputer Services of Natick, MA. Their FORTH is complete and well thought out, contains many extensions, and comes with an interactive 8080 assembler, among other useful items. Both tape and disk-based versions are available.

Sirius Systems, Programma International, and the Software Farm are some of the other suppliers of FORTH for the TRS-80. I

want to leave you with one final warning: Good FORTH tutorial manuals are almost nonexistent at the present time. ■

```

0 ( REVERSE: ACCEPTS STRING FROM KEYBOARD AND INVERTS IT )
1
2 : GETCHARACTERS CR -1
3   BEGIN
4     KEY DUP DUP ECHO 13 =
5   END ;
6
7 : POPANDPRINT
8   BEGIN
9     DUP ECHO -1 =
10  END ;
11
12 : REVERSE
13   BEGIN
14     GETCHARACTERS POPANDPRINT 1 1 <>
15   END ;

```

Program Listing

PPI-80

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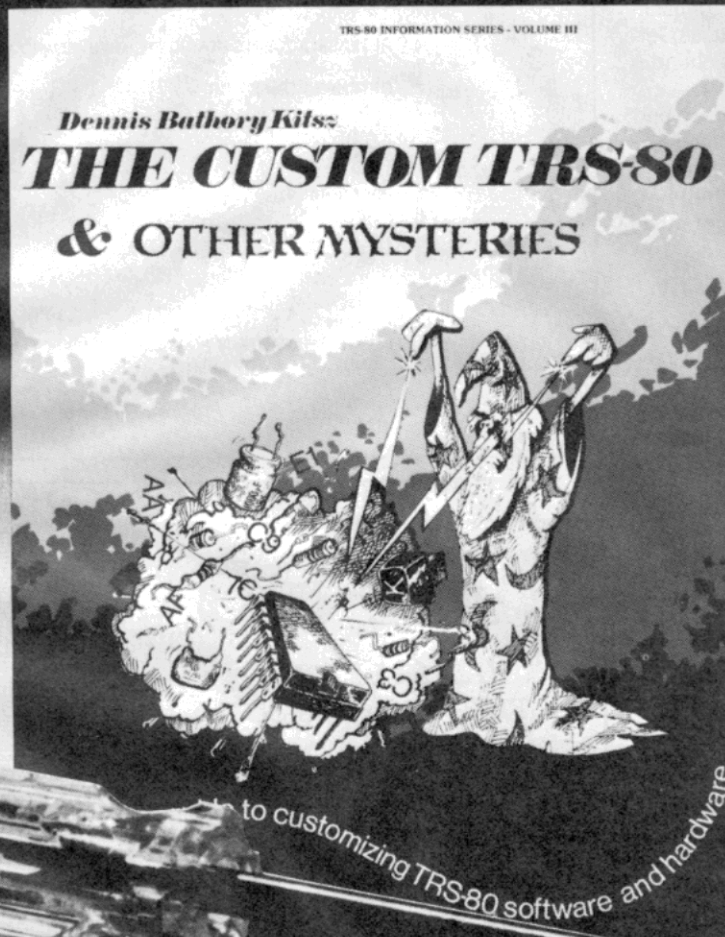
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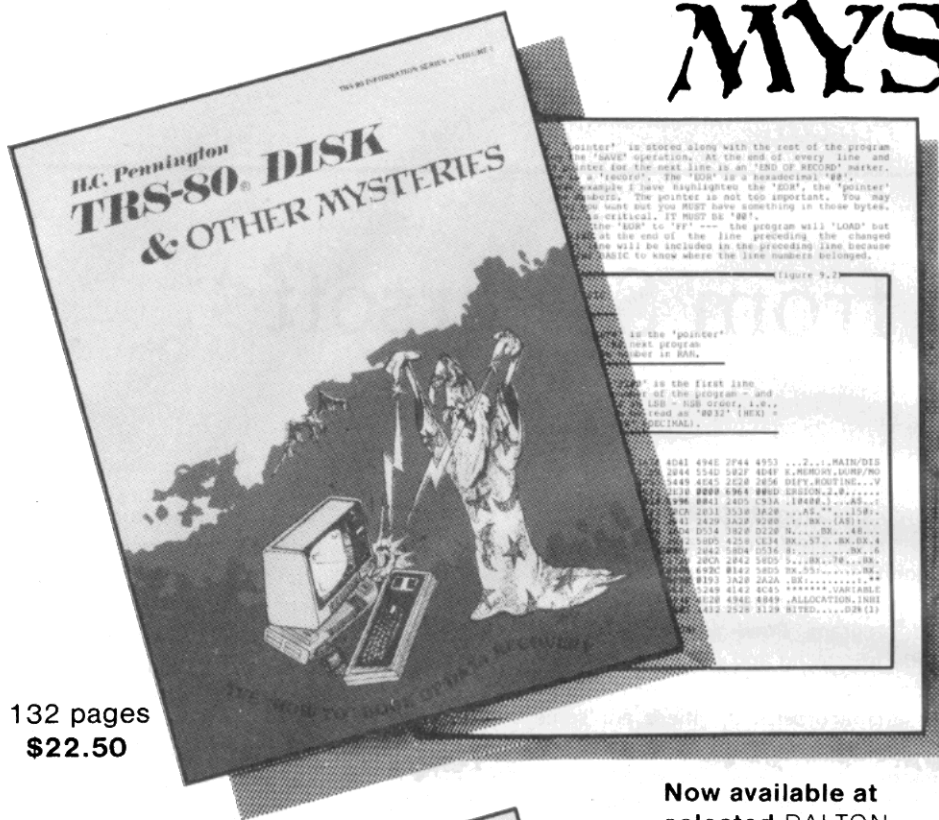
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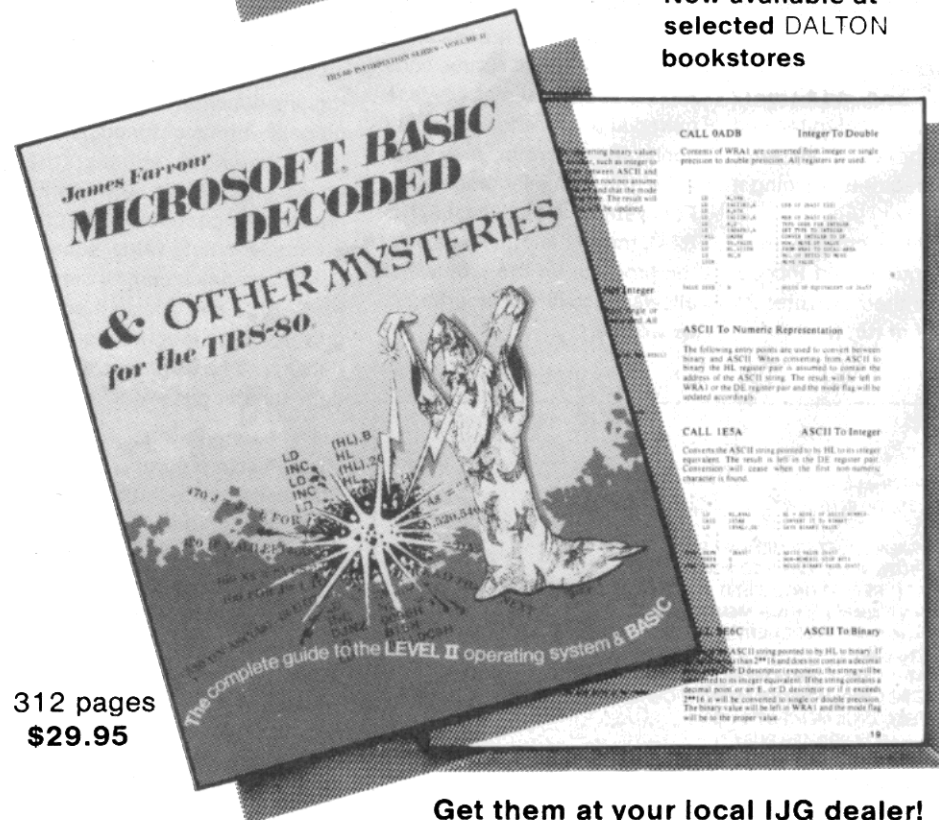
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One day while I was thumbing through a magazine, I saw an ad for a 'Tiny' Pascal. I'd been interested in Pascal for some time. All the compilers I'd seen required a disk drive, or two, and at least 32K of memory. This Pascal required 16K, a cassette-equipped machine, and I sent for it.

The first thing I wanted to do, of course, was load the tape. I was disappointed to discover the program was only recorded once. Fortunately, the tape loaded.

The manual is not a primer on Pascal, so I bought one of the references recommended and began learning this new language. The syntax is simple, and before long I had written my first program. When I decided to list the program on my printer, I got my second big disappointment. There was no provision for printing lists, or outputting to a line printer under program control. I decided to write some programs that would provide these capabilities. (Program Listings 1 and 2.)

The system consists of four major parts: monitor, editor, compiler, and run time interpreter.

The monitor is in charge of overall system control. From the monitor you can enter the editor to create or modify source code, compile source code, and run the compiled program. Provisions are made for saving and loading source code or P-code using the cassette recorder.

The editor is adequate but doesn't compare with the Level II BASIC editor. Provisions are made for listing part or all of a program. Lines may be inserted or deleted and additional characters appended to the end of a line. Correcting an error within a line requires retyping it completely.

The compiler generates an intermediate code called P-code. The P-code is then executed by an interpreter at run time.

This leaves the programmer with about 4½K of memory for source and P-code. Normally the source code is entered and when it's compiled, the P-code immediately follows the source code in memory.

However, for large programs there are some options available. The programmer may choose to have the P-code replace the source code as it is compiled, making it possible to have a full 4½K of source code. Also, if additional memory is required at run time for arrays and such, the operator may overwrite the compiler and editor. For systems with at least 32K of RAM, there is another version of the program on the tape which allows much larger programs to be written.

What It Can Do

'Tiny' Pascal only supports integer variables. Lack of real (floating point) and character (string) variables limits its usefulness. All major control structures of Pascal are supported, including Begin...End, Repeat...Until, While...Do, If...Then...Else, For...Do, Case, Procedures, and Functions. Statements provide Read, Write, and integer arithmetic in decimal or hexadecimal, including one-dimensional arrays. Additional intrinsic functions include memory access (the equivalent of PEEK and POKE), machine language calls, I/O port access, absolute value, square, INKEY, graphics control similar to BASIC, and block memory moves. Game programmers will be sorry to hear there is no random number generator.

The listings are examples of 'Tiny' Pascal programs and provide some needed utilities. Program Listing 1 allows a program to be printed on the line printer. This program should be inserted before the program you want printed out. The compiler will only compile the List program and when executed, only the second program will be printed. Comments, of course, may be eliminated. They are enclosed by (* *). Using this technique, a program about 4K in length may be printed.

Program Listing 2 is a general purpose screen print routine. The parameters passed to it are

```
(*
(* LIST *)
CONST PNTR = 14312;
VAR MP, TS, TA: INTEGER;
BEGIN
  MP := %498E; (* SET UP MEMORY POINTER *)
  MEM(PNTR) := 10; (* CR/LF TO PRINTER *)
  REPEAT (* REPEAT UNTIL FIRST PERIOD ENCOUNTERED *)
    TS := MEM(MP); (* FETCH MEMORY CHARACTER *)
    MP := MP + 1; (* INCREMENT MEMORY POINTER *)
  UNTIL TS = 46;
  REPEAT (* REPEAT UNTIL PERIOD ENCOUNTERED *)
    TS := MEM(MP); (* FETCH MEMORY CHARACTER *)
    REPEAT UNTIL MEM(PNTR) < 128;
    (* WAIT IF PRINTER BUSY *)
    IF TS = 9 THEN FOR TA := 1 TO 3 DO MEM(PNTR) := 32;
    (* INSERT TAB *)
    MEM(PNTR) := TS; MP := MP + 1;
    (* OUTPUT TO PRINTER AND INCREMENT MEMORY POINTER *)
    UNTIL TS = 46;
    MEM(PNTR) := 10; (* OUTPUT CR/LF TO CLEAR PRINT BUFFER *)
  END.
```

Program Listing 1

While Level II BASIC is still more practical for any application, 'Tiny' Pascal offers a "shoestring" approach to learning this structured language. ■

While Level II BASIC is still more practical for any application, 'Tiny' Pascal offers a "shoestring" approach to learning this structured language. ■

A 100x100 grid of various ASCII characters and symbols, including letters, numbers, punctuation, and special characters, arranged in a dense, repeating pattern.

Figure 1

```
(* SCREEN PRINT *)
VAR STLN, NMLN, SADD, CHAR, CCNT: INTEGER;
PROC SPNT(STLN, NMLN);
CONST PNTR = 14312;
VAR FADD, LADD, CADD, TS: INTEGER;
BEGIN

FADD := STLN*64 + 15296; LADD := NMLN*64 + FADD - 1;
(* COMPUTE FIRST AND LAST SCREEN ADDRESS *)
MEM(PNTR) := 10; (* OUTPUT CR/LF TO PRINTER *)
FOR CADD := FADD TO LADD DO (* SET UP LOOP *)
BEGIN
    TS := MEM(CADD); (* FETCH CURRENT SCREEN ADDRESS CHAR *)
    IF CADD MOD 64 = 0 THEN MEM(PNTR) := 10;
    (* CR/LF IF END OF LINE *)
    REPEAT UNTIL MEM(PNTR) < 128; (* CHECK FOR BUSY *)
    MEM(PNTR) := TS (* OUTPUT CHARACTER TO PRINTER *)
END;

BEGIN (* MAIN PROGRAM TO TEST SCREEN PRINT PROCEDURE *)
WRITE(28,31); (* CLEAR SCREEN *)
WRITE('FIRST LINE'); READ(STLN#); WRITE(10,13);
(* INPUT FIRST SCREEN LINE TO PRINT *)
WRITE('NUMBER OF LINES'); READ(NMLN#); WRITE(28,31);
(* INPUT NUMBER OF LINES TO PRINT *)
CHAR := 49; (* ASCII OF CHARACTER TO SCREEN *)
SADD := 15360; (* FIRST SCREEN ADDRESS *)
REPEAT (* REPEAT UNTIL SCREEN FULL *)
    FOR CCNT := 1 TO 64 DO
    BEGIN
        MEM(SADD) := CHAR;
        SADD := SADD + 1
    END;
    CHAR := CHAR + 1
UNTIL SADD >= 16383;
SPNT(STLN,NMLN) (* CALL SCREEN PRINT PROCEDURE *)
END
```

Program Listing 2

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The Last CLOAD Fix

Walter L. Stanley
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The critical volume setting required for an error-free CLOAD has been of concern to most TRS-80 owners from the time they first installed Level II ROMs. As reported in the *Radio Shack Microcomputer Newsletter*, (May, 1979), they have developed a fix which they will install free of charge in all TRS-80s, provided the seal is unbroken. Harold Smith reported in the first issue of *80 Microcomputing* (80 Input) that the fix, which is on a $1\frac{1}{2}'' \times 1\frac{1}{2}''$ circuit board, is effective and well worth having installed. Other sources have likewise praised the modification as almost completely curing the CLOAD problem of volume sensitivity.

Alas, there is a substantial minority of TRS-80 owners who long ago opted to get inside the computer and change things around to improve and understand their machine. We did this with full knowledge that we gave up the option, forever, of having Radio Shack work on our TRS-80s. What are we to do to improve CLOAD?

We can plunk down \$30 to \$50 for an outboard cassette interface device to clean up the cassette signal, or we can continue

to experience that sinking feeling when a C replaces the asterisk at the end of a five-minute program load.

I was delighted to have the opportunity to see inside a TRS-80 which has the CLOAD fix installed. (I understand that the modification is labelled the X2X mod by Radio Shack). Naturally, I documented it by tracing wires and foil cuts, and then spent a number of hours trying to understand it. I'd like to share

what I found with you, since Radio Shack installs this mod at no charge, and I don't believe they would object to an owner building and installing it himself. The circuit can be built for less than \$3 and an hour of time.

Fig. 1 is a combined circuit diagram and logic function diagram. Referring to the schematic in the *TRS-80 Microcomputer Technical Reference Handbook* is helpful, but not essential. The original cassette input circuit

takes the recorder signal (CASSIN) through all four sections of a 3900 Norton amplifier (Z4 in the technical manual) where it is filtered, amplified, inverted, squared up, and desensitized to noise. The output of the final section of Z4 will be called CASSIN* since it is inverted. (To follow Radio Shack's notation, all active low signals are followed by an asterisk.) CASSIN* is normally high, and goes low in response to any signal from the

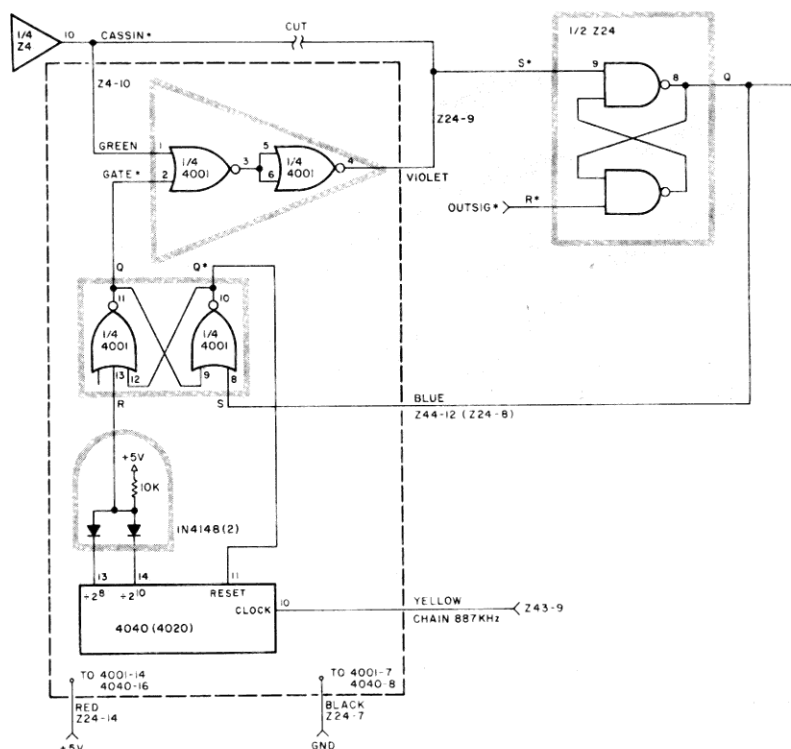


Fig. 1. This is the schematic for the CLOAD fix, with its location in the TRS-80 electronics. The dotted lines enclose all new components, which mount on a single $1\frac{1}{2}'' \times 1\frac{1}{2}''$ piece of perf board. The blue overprinting shows the grouping of gates functionally. An asterisk after a signal's label denotes active low logic.

recorder, be it a clock pulse, a data pulse, or noise that isn't filtered out. The recording format consists of clock pulses at two millisecond intervals and data windows halfway between clock pulses. A pulse will actually be present during this window if the data bit is a 1, but no pulse will occur if the data bit is a 0. It is possible, therefore, to see a legitimate pulse on the CASSIN* line as often as every millisecond.

What happens during a CLOAD is this: The cassette recorder is turned on by outputting data to port 255₁₀. Any output instruction to port 255 causes a signal line called OUTSIG* to go from high to low for the duration of the instruction (a matter of microseconds). Among other things, OUTSIG* is connected to pin 13 of Z24, an input to one of two NAND gates configured as an R-S flip flop. Pin 13 is the reset input of this flip flop, and since a negative going pulse causes the activity,

we call that input R*.

With the recorder now running, eventually a pulse on CASSIN* will reach pin 9 of Z24 which is the set input (labelled S*) of that flip-flop. This pulse causes the Q output, pin 8 of Z24, to go high. The cassette input software immediately detects this high and executes an output instruction to port 255. This brings OUTSIG* low which resets the flip-flop and returns Q to a low state. The software is, meanwhile, in a carefully timed delay routine, and shortly after one millisecond has passed, it again tests whether Q is high or low. If it is high, another output instruction causes OUTSIG* to go low and resets the flip-flop. If Q is low, the software waits patiently for the appropriate time to test Q again.

The only flaw in the system is that any pulse that gets through the four sections of Z4 will set the flip-flop, which will stay set until the software tests its state. A noise pulse will always be

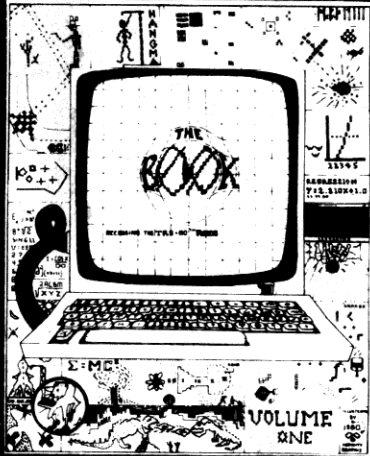
seen as a 1 data bit, hence, the volume setting is critical. If it is too low, valid data pulses are missed; too high, too much noise is seen as data. And yet, there is only a tiny time interval during which it is possible for a valid pulse to be on the tape.

The solution exhibited by most of the outboard cassette improvers I have seen is to provide a noise-free signal to the cassette input of the computer. Essentially, this is done by a more sophisticated pulse shaping circuit than Radio Shack uses (Z4) which has the effect of presenting a digital rather than an analog signal to the computer. For those of you who do a lot of tape duplication, I heartily recommend that approach. For those of us not into tape duplication, it seems to be an approach that transforms a cheap tape recorder into an expensive one.

An alternate answer is to make Z24 insensitive to noise for most of the inter-pulse time;

that is, to turn off the S* input to Z24. This could be done with software by delaying the output instruction to port 255, thus delaying the reset of Z24 until just before the next valid pulse is expected. In fact the new Level II two-chip ROM set does just that. Unfortunately, a 32K PROM is very expensive, and that is what contains the cassette load software. The Radio Shack CLOAD modification provides a cheap hardware alternative to an expensive reprogramming of the ROM software. Note from Fig. 1 that the direct path between pin 10 of Z4 and the S* input (pin 9) of Z24 is cut. Instead, the output from Z4 is routine to Z24 via a gated buffer made from two sections of a CD4001 quad NOR gate.

The buffer works as follows: So long as the input labelled GATE* is low, CASSIN* at pin 1 will be inverted at pin 3. The second NOR gate is merely an inverter, so the output signal finally presented to S* of Z24 is in-




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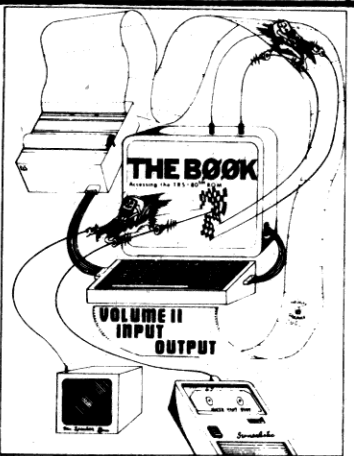
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deed CASSIN*. But if GATE* is made high, then pin 3 of the NOR gate will be low regardless of the state of CASSIN*, and Z24 sees only a high. The balance of the circuit controls GATE* so that after Z24 is set by a pulse, no further pulse can pass to Z24 until about 0.72 milliseconds later.

In order to accomplish that, the remaining two NOR gates are configured as an R-S flip-flop. Since the flip-flop is made of NOR gates, positive pulses set or reset its state. The set input, labelled S, is at pin 8 and is connected to the Q output of Z24. Take my word for it; pin 13 of the flip-flop, which is the reset input, is low at the start of a CLOAD, so Q* (pin 10) is high, which means that pin 11 (the Q output) is low, and so GATE* is low, and the gated buffer is free to pass CASSIN* right through to S* of Z24. Meanwhile, the Reset input of the CD4040 counter is held high since it, too, is connected to Q*, and this forces

pins 13 and 14 of the counter low. The two diodes and the pull-up resistor form an AND gate, so the R input of the flip-flop is low.

Execute CLOAD, and wait for the first pulse. When it comes, it will pass right through the gated buffer and reach S* of Z24, triggering that flip-flop and causing Q to go high. This high triggers the set input of the NOR gate flip-flop, and so Q* goes low and Q goes high. Q high shuts the gate to any further pulses from CASSIN*, so that any pulses on CASSIN* (which must be noise) get sent to the bit bucket. Simultaneously, since Q* is low, Reset of the CD4040 is low, and the counter starts doing its thing at 887 KHz. About this time OUTSIG* goes low because the software saw that Q of Z24 was high. Q of Z24 goes low in response, and nothing else happens for awhile.

How long is awhile, you ask? Well, the CD4040 is happily counting pulses, and after 128 of them have been counted, pin

13 goes high (this is the divide by 2⁸ output). Since the diode configuration is an AND gate, nothing happens. After 512 pulses have been counted, pin 14 goes high, but pin 13 has gone back low, so still nothing happens. But 128 pulses later, both pins 13 and 14 find themselves high, and the 10K resistor brings pin

13 of the CD4001 high. That resets the flip-flop, which lets CASSIN* get through to Z24 once again. "Awhile" turns out to be 1/887,000 times 640, or about 0.72 milliseconds, give or take a few microseconds.

These five components keep possible noise on CASSIN out of the system for nearly 75 percent

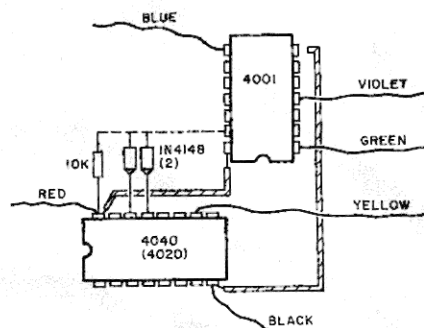


Fig. 2. Parts placement on the perf board is designed to permit use of component leads for much point to point wiring. In particular, note the placement of the diodes and resistor to allow their leads a straight shot to the IC pins to which they are soldered. Aside from the flying leads to the main circuit board, only +5V and ground wiring is on the top of the board.

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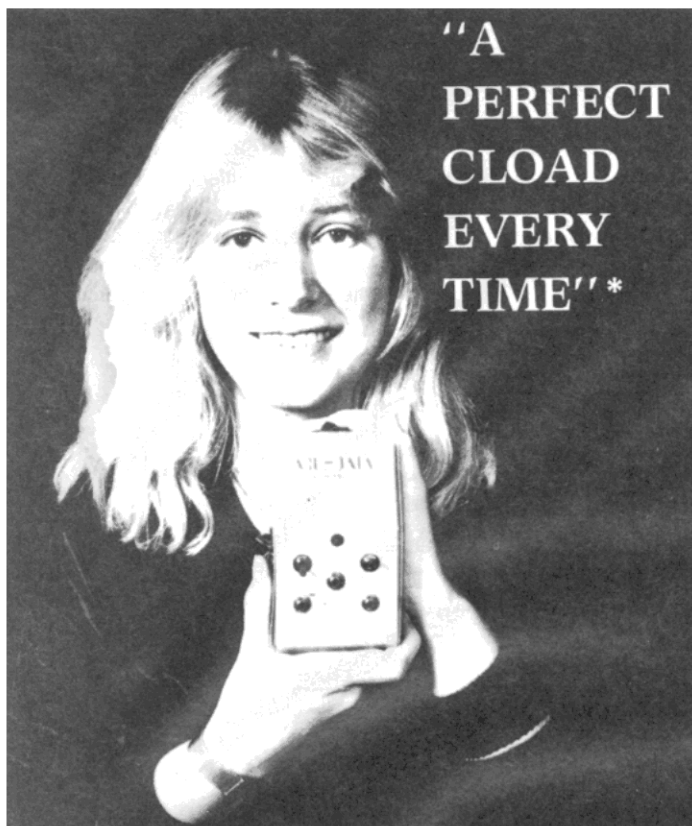
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of the time between legitimate pulses. There is still a time interval when a noise pulse could trigger Z24 erroneously, but one does have to allow for variations in cassette recorder speed. Keeping noise out for 75 percent of the time gives a whopping improvement in reliability, especially when you consider that even if a noise pulse triggers the Z24 flip-flop, the next data pulse would have been a 1 about 50 percent of the time anyway. All this means that you can tolerate more noise output from Z4, which allows you to crank up the volume or your recorder by a pretty wide margin. This, in turn, means you are not as likely to lose legitimate data pulses. It doesn't seem, however, that this fix would do anything to help CLOAD at lower than recommended volume settings.

Building the circuit is very simple. Five components don't justify even a thought of a printed circuit board, so chop yourself off a 1½ inch x 1½ inch piece of perf board with holes on 1/10 inch centers. Layout of parts is not critical, but the arrangement shown in Fig. 2 allows some wiring with component leads. Contrary to many cautions, I have not found CMOS integrated circuits that fragile, and if you exercise reasonable care to avoid generating static electricity and solder quickly, you won't need solder sockets. Fig. 3 is a pictorial rep-

resentation of the wiring on the underside of the board. (The only hooker in this project may be finding a CD4040. If you have one on hand, use it, but don't try to buy one at Radio Shack—it's not in their catalog.) Instead, pick up a CD4020. This is also a ripple counter, and thankfully, the pinout is identical to the CD4040 for the pins we use.

Time now to open the computer. If you are building this circuit you've done that before and don't need detailed instructions. Swing out the keyboard, there's no need to remove the main circuit board. With the keyboard unit positioned normally—that is, with the tape, video, and power jacks at the upper right hand corner—you will see a set of four rows of ICs from the foil side of the main circuit board. Z4 is the rightmost IC in the top row, and Z24 is directly below Z4 in the second row. Pin 1 of all ICs is the top right pin. Carefully cut the trace leading from Z4 pin 10 to Z24 pin 9. Solder the red +5V lead from the perf board to pin 14 of Z24, and the black ground lead to pin 7 of Z24. Any other convenient power take off points may be substituted. Solder the green wire to Z4 pin 10.

Locate Z43 and Z44 as follows: Directly below Z24, in the third row of ICs is Z42; immediately to the left is Z43, and to the left of that is Z44. Now solder the blue wire to Z44 pin

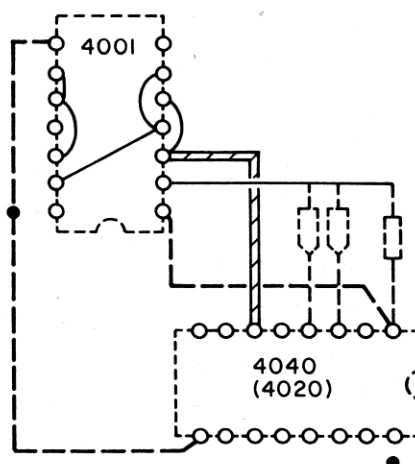
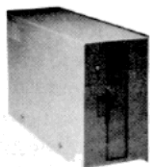


Fig. 3. The underside of the board shows the simple wiring required. Bend the resistor lead at a right angle to the resistor body and solder it directly to pin 13 of the 4001, then spot solder the diode leads to it. The connection from pin 12 of the 4001 to pin 11 of the 4020 (4040) should be insulated.

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10, or alternatively to Z24 pin 8. Solder the violet wire to Z24 pin 9, and finally solder the yellow wire to Z43 pin 9. Swing the keyboard back in place, and using double sided foam tape, attach the perf board to the foil side of the main PC board at a convenient location. If your computer has as many mods as mine, this last step may be the most difficult! (Incidentally, the foam tape sold by Radio Shack is a little thin, and I recommend using a double thickness.)

It probably took you longer to read this article than it did to build up and install the modification. Close up the computer, crank it up, and CLOAD away! I have been CLOADing with the volume on my recorders cranked up to the stops with super results. The insensitivity to volume setting is great, and our friends at Tandy really did a good job with this modification.

Warning

The circuit I have described is the exact circuit installed by Radio Shack (except for the substitution of a CD4020 for the CD4040). Whether you build and install it, or have Radio Shack do it for you, any tapes CSAVED with any of the CPU clock speedup circuits installed and with the CPU operating at the higher speed become impossible to load. Here's why: When the Z80 is being driven by the faster 2.66 MHz clock, the software timing of the cassette input routines sets up an expected clock pulse interval of 1.33 milliseconds instead of 2.0 milliseconds. Therefore, a data pulse would be expected at 0.67 msec, but the CLOAD fix locks out CASSIN* for 0.72 msec. The software literally never sees a data pulse! Why doesn't the clock also speed up that 887 KHz we used to feed the counter in our modification? Because that frequency is part of the video timing (it's called CHAIN in the *Technical Reference Handbook*), and fortunately, every inventor of a clock speedup circuit knows you don't fool around with video timing. So, do your CLOADing at normal clock speed, and execute your programs at the faster speed after

they are safely in memory.

Alternatively, a modification can be made to the clock speedup circuit described in *80 Microcomputing* (Feb., 1980, see "Faster, Faster" by Dennis Kitz). I have not yet built the speedup circuit, and so haven't tested it, but it should work. Mr. Kitz uses two sections of a 74LS367 which he calls ZSPEED to gate either the fast or regular clock to the Z80. Break the connection of the diode at pin 13 of the CD4020 on the CLOAD modification and run a lead from pin 13 to pin 4 of ZSPEED. Run a second lead from pin 5 of ZSPEED to the cathode end of the diode you just disconnected. Pins 4 and 5 of the 74LS367 are an unused buffer whose tri-state output state follows the normal speed clock control line.

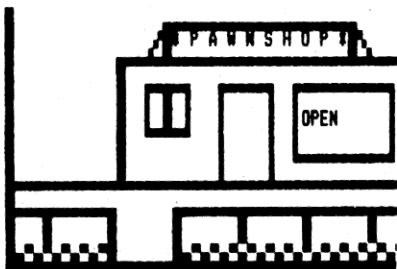
With the normal speed clock active, the path from pin 13 of the CD4020 and the diode is made, and the CLOAD fix operates as previously described. However, when the fast clock is selected, the pin 5 output of the 74LS367 is tri-stated. Therefore, the Reset input of the NOR gate flip-flop will be triggered when pin 14 of the CD4020 goes high, after only 512 clock pulses. This works out to a time delay of 0.58 milliseconds, and although a little close, should still allow a pulse on CASSIN* every 0.67 milliseconds to go through the system.

Most of us who have opened our computers have done so more than once, and have made several modifications. Therefore, I can't guarantee this compatibility of this modification with your system, or predict what impact it may have in connection with other mods you may have made. You must assume responsibility for any mods you make, including responsibility for their compatibility in combination in your TRS-80. But it sure is nice to know about some of the fixes that come out of Fort Worth, and I hope all who find out about one will take the trouble to share the information. Anyone know what the fix to the computer and expansion interface which corrects disk rebooting looks like? ■

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A computerist's view of how it all began, seen in 20/20 hindsight.

Getting Involved

Robert A. Batty, W0KSG
2657 S. Bonanza Ave.
Tucson, AZ 85730

I've never liked Radio Shack because my few visits to their stores usually result in leaving empty-handed. I can never find the right parts!

I've been an amateur radio enthusiast for years, observing the Tandy Corporation's disregard of the ham's needs for parts and publications. I've avoided Tandy as best I can.

But, after reading two and one-half years of *Kilobaud Microcomputing* and other microcomputing magazines and watching the performance ratings of the TRS-80 climb, I bought the Radio Shack product.

Spending \$500 in an enemy camp is not pleasant, but I did it when Tandy reduced their \$600 TRS-80 by \$100.

Justifying the Purchase

There were more important factors than the low price of the TRS-80 in my decision to buy.

I started with a minimum configuration. Later I could upgrade to a system with disk drives, printer, and more memory, and even used other manufacturer's equipment.

Second, the TRS-80 qualifies as good word processing system. I felt uneasy about spending in excess of \$2000 for a text editing, non-dot-matrix printer subsystem for the TRS-80. Instead, the Anderson-Jacobson, as recommended by Allan Domuret (*Kilobaud Microcomputing*, June, 1977) was in the \$1000 range, I found.

Third, Tandy had published the manual, *TRS-80 Microcomputing Technical Reference Handbook*, complete with schematics. It convinced me that do-it-yourself maintenance of their product was possible.

Installation and Checkout

Unpacking and cabling the cassette recorder, video display, and keyboard was uneventful. I was impressed with the quality of the shipping package. (The octopus of exposed cables upset me, however—there had to be a better way.) The checkout procedures verified that I had indeed purchased a working system. The accompanying games, Blackjack and Backgammon, indicated further that my TRS-80 produced the desired results.

Dr. Lien's *Basic Computer*

Language, which is included in the purchase price of the TRS-80, Level I system, is a fun course in learning Level I BASIC programming. If supplemented with another Lien text, *The Basic Handbook*, you will be able to adapt most published programs to fit in the 4K of memory in Level I.

Outgrowing the System

I soon found out (shortly before the 90-day warranty expired) that the Level I language was inadequate. An increase in memory was essential. I decided I could install the extra memory expansion modules in the keyboard unit myself. Consequently, Radio Shack's installation of the Level II came next. (Radio Shack can determine if an owner has tampered with a computer by covering an access screw with glyptol, a sealing wax that is destroyed by removing the screw. Destroying the glyptol will not only void the warranty, but there are rumors that the repair centers will charge a premium for servicing tampered-with keyboards.)

The upgrade to Level II at the repair center took less than a week. I checked it functionally by stepping through most of the test programs in *The Basic Handbook*. Success again, I thought, but troublesome times were ahead.

Disappointment After Disappointment

The Level II change included a manual entitled *Level II Basic Reference Manual*, disappointment number one upon graduating to Level II. Poorly written, containing none of the educational assistance taken for granted in the Level I manual, an inadequate table of contents and no index, I had the distinct feeling of being ripped off.

Fortunately, "TRS-80 Level II Reference Manual Index" by Sherman P. Wantz appeared in the February 1979 *Kilobaud Microcomputing*. This article allowed me to make a real reference manual out of Radio Shack's, even providing a page renumbering scheme.

Another shortcoming was soon to come—keybounce. This problem had been widely publicized in the personal computer magazines, but I hadn't experienced it until Level II was installed. This is possibly because I diligently kept the keyboard covered when not in use. Keybounce is the double entry of a character on a single keystroke. This problem is fixed by periodically removing the keypads of the faulty characters and cleaning the contacts. I found that Radio Shack's program, KBFIX, which is supplied with the Level II change, satisfactorily overcame the problem. The short

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KBFI program must be loaded each time the system is powered up.

My biggest disappointment, still unresolved, is the cassette loading problem. The Level II change increased the data rate during program loading and saving. This caused the volume control on the recorder to become sensitive. I must praise Radio Shack, who tried to overcome the problem by returning my equipment more than once to the repair center, resulting in some improvement. My program loading abort rate remains at about 10 percent however, which I consider too high. I have attained this rate only by using Peripheral People's "Data Dubber", constantly cleaning the tape path of the recorder, and using Memorex MRX3 oxide tapes, which have produced better results than all the other brands of tapes I tried. Fortunately, after saving programs, the CLOAD? command ensures that programs saved were actually recorded without error.

A minor concern was the failing recorder motor start relay (located in the keyboard). The relay contacts would weld while loading a program from tape. Instead of stopping when READY appeared on the screen, the recorder would proceed to the end of the tape. I found this could be minimized by hitting Enter before activating the recorder on a load or save command. The recorder play switch then takes the arc during the motor start operation.

Convinced now that my Level II required no further warranty

maintenance, I ordered the 16K memory modules and jumpers. Installation in the keyboard was straightforward. Care must be taken, especially when flexing the cable joining the two boards. I was advised to use caution when handling the modules as they are extremely sensitive to static electricity.

After re-assembling the keyboard and re-installing the system cables, I was pleased to note the correct response to the PRINT MEM command. More rewarding, I was finally able to key in and run all those programs labelled Level II, 16K.

For the first time, I was thoroughly enjoying my TRS-80, doing all the things my Level I, 4K system couldn't support. Most of the programs published in the microcomputer magazines ran. Converting other systems' languages to the Microsoft BASIC of the TRS-80 was challenging, and especially rewarding when they ran without bugs.

But, in modifying and debugging programs, I found it extremely difficult to follow a program listing on the video screen, scrolling back and forth as the GOSUB and RETURN instructions demanded. Another problem. The only way to overcome this shortcoming was to attach a printer to the system. Inasmuch as word processing was ultimately a requirement for my system, I considered making the purchase.

A Selectric word processing printer such as the Anderson-Jacobson mentioned earlier was out of the question due to my lack of funds. A local Radio Shack flier arrived in the mail, offering the TRS-80 Quick Printer at quite a discount off their \$499 catalog price.

This was the time to see if a discount Radio Shack would consider a 10 percent discount off the flier price. I phoned and they agreed. As shown in Table 1, I became a printer owner at a fairly reasonable cost.

Printer Arrives

The printer arrived in five days and again I must commend the outstanding packaging done by

Tandy.

A roll of aluminum-finish paper came with the printer (I hadn't expected this and had ordered an additional three). After installing the cable from the printer to my keyboard, I was ready to go.

Three print sizes were available and 150 lines per minute was the output speed. I was pleased and proceeded to print some of the programs I wanted to modify. My only gripe now was the uppercase/lowercase confusion factor—to print lowercase, the shift key must be depressed when entering data. This deficiency is not the fault of the printer, however. Using the aluminum paper is also not as disadvantageous as I thought; a felt-tipped pen does an adequate job making corrections on it.

I bought Peripheral People's Data Dubber not only to improve the tape loading problem, but to copy the machine language tapes I needed for backup. Not included in the expenditure

table are the magazine subscriptions or necessities like tape head cleaner and cassette storage cases.

Would I Do It Again?

Absolutely. And in the same sequence: Level I, 4K, Level II, the 16K modification, and finally the printer.

Based on my pleasant experience with the printer, I would recommend mail-ordering the entire system. Warranty maintenance presents no problem. The only requirement is a sales receipt showing date of purchase.

Why not Level II initially? Three answers: (1) The Level I instruction manual is a rewarding way to get started. (2) Level II is more appreciated when it follows Level I. (3) Good programming habits are formed when memory is in short supply (4K).

Additionally, how would one know about the program loading deficiency if one hadn't started with Level I, where it doesn't exist? ■

Word Processing? You need a SPELLING CHECKER

This is an example of a text being checked by HEXSPELL. The text scrolls up the screen as it is checked. When an error is detected, you have three choices.

- 1) REPLACE the incorrect word. The replacement word is INSTANTLY RE-CHECKED for correctness, then inserted in the text.
 - 2) The word is correct, leave it as it is.
 - 3) Leave the word as it is, AND tell HEXSPELL to LEARN this word for future reference, with just one keystroke.
- Your document is ready to print as soon as HEXSPELL is finished. The word in error e.g. *

WORD IN ERROR: mistake
CONTINUATION: is shown in context, including continuation
PRESS: R) REPLACE WORD S) LEAVE AS IS L) LEARN WORD

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Lien The Basic Handbook	16.00
Lien Learning Level II	17.00
Radio Shack TRS-80 Micro-computer Technical Reference Handbook	11.00

Table 1

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XBASIC—Six single key stroke commands to list the first, last, previous, next or current program line, or to edit the current line. Includes quick way to recover BASIC program following a NEW or system or accidental re-boot. Ten single character abbreviations for frequently used commands. AUTO, CLS, DELETE, EDIT, KILL, LIST, MERGE, NEW, LLIST, and SYSTEM.

XREF—A powerful cross-reference facility with output to display and/or printer. Trace a variable through the code. Determine easily if a variable is in use.

XDUMP—Permits the programmer to display and/or print the value of any or all program variables. Identifies the variable type for all variables. Each element of any array is listed separately.

XRENUM—An enhanced program line renumbering facility which allows specification of an upper limit of the block of lines to be renumbered, supports relocation of renumbered blocks of code, and supports duplication of blocks of code.

XFIND—A cross reference facility for key words and character strings, also includes global replacement of keywords.

XCOMPRESS—Compress your BASIC programs to an absolute minimum. Removes extraneous information; merge lines; even deletes statements which could not be executed. Typically saves 30-40% space even for programs without our REM statements! Also results in 7-10% improvement in execution speed.

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SUPERSNAPP X is the most important component of SNAPP X EXTENDED BUILT-IN FUNCTIONS which is a much needed set of additions to the Model II BASIC interpreter that will put time saving power at your fingertips. Let's compare (using random data) SUPERSNAPP X and Racet's GSF SORT for speed.

	SORT	SUPERSNAPP X	RACET GSF
10,000 integers	39 seconds	59 seconds	
5,000 Singles	22 seconds	34 seconds	
2,000 Strings	10 seconds	15 seconds	

SUPERSNAPP X is guaranteed to be the FASTEST in memory SORT on the market or your money back. With it you also get these EXTENDED BUILT-IN FUNCTIONS: PEEK, PEEKW, POKE, POKEW, XDATS, XTIMS, ETIMS, FILES, AND THE SPECIAL SCMD (SNAPP__COMMAND). PLUS: open "E" Set SCROLL PROTECTION. ERASE all ARRAYS in one command. Specify size and Blink rate of CURSOR. LONG ERROR MESSAGES. Read from Video Screen Read. PEEK complete strings from memory. POKE complete strings to memory. convert upper case to lower case and vice-versa. turn complete screen off and on at will. extract largest or smallest values from user supplied list of numbers.

We consider this next function as probably the most powerful addition ever made to Microsoft BASIC. **PRINT USING INTO A STRING**. The ability to arrange data into a string variable should perk your imagination.

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called glitches) can have a wide range of effects on your computer, from no effect at all to complete destruction of the system. Typical glitches cause the program you've been working on for

three hours to get confused or totally and unrecoverably wiped out. A power line transient is a momentary excursion of the power line voltage amplitude large enough to inject into your

system's logic. Transients have many sources besides lightning; the most common household sources of glitches is probably an induction motor like those found on the compressors of re-

One rainy day, a friend was working on his computer when lightning struck across the street. For a brief moment the computer was working on itself. The lightning only destroyed one inexpensive IC, but in his excitement to find out what happened, my friend shorted out several other ICs. The whole problem might have been avoided with a good power line transient suppressor.

Power line transients (often

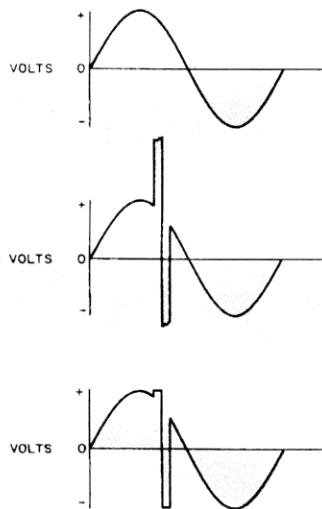


Figure 1. A typical transient

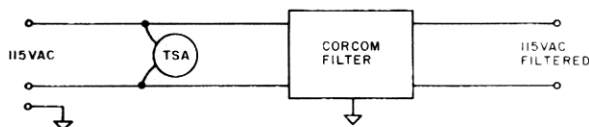


Figure 2. Modular Corcom filter in circuit

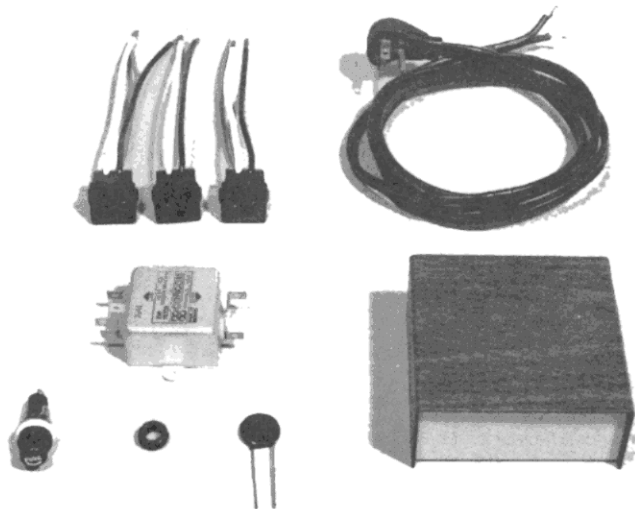


Photo 1. Pictured are all parts necessary to build the line filter. From left to right, top to bottom: chassis mount receptables (three-wire grounding type), line cord, RFI filter, metal enclosure, fuse holder, rubber grommet, ZNR transient surge suppressor.

Parts List

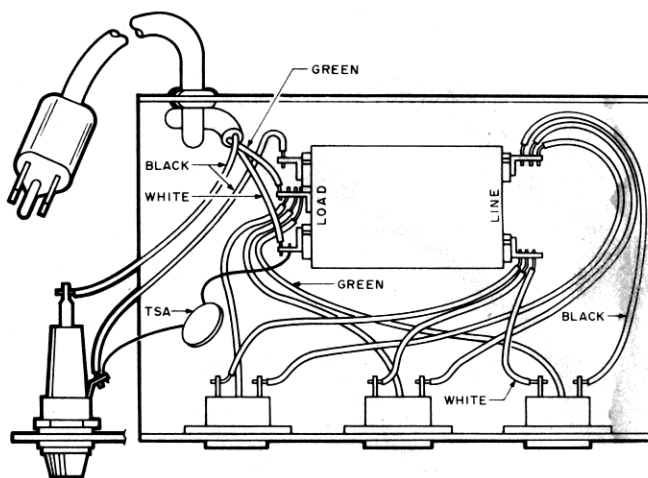
One AC line cord w/ground, Jameco 17236
One CORCOM 10k1 power line filter (10 amp)
One transient surge absorber, ZNR-K201
One metal housing, TEN-TEC TW-24
Three AC sockets, WABER #3015
One rubber Grommet or Strain Relief for Line Cord Radio Shack 278-1636 or 64-3025
Two 6-32 x 3/8 Flat Head Screws with Lock Washers and Nuts or two pop rivets
1 Ft. #18 Gauge Stranded Hook-up wire

Fig. 1 shows a typical transient. We can avoid most and minimize all transient problems with a simple and inexpensive power-line filter. We can give our suppressor extra muscle by adding a transient surge absorber (TSA). The surge absorber acts like two back-to-back zener diodes and clips the transient as it attempts to rise above a predetermined level. If the filter doesn't get it, the transient surge absorber will.

The circuit is extremely simple because it employs a modular Corcom filter (Fig. 2). The most difficult part of this project is cutting square holes for the 115 volt receptacles (Fig. 3). I cut mine with a Mototool emery

Mount all parts as shown in the photos, remembering to mount the line side of the Corcom filter toward the powercord insert hole.

After all parts are securely tightened, start your wiring as shown in Fig. 4. A note on soldering here may help the novice. First, clean and "tin" your soldering iron (do not use a soldering gun). Simply run the iron's tip over a moist sponge until the crusty stuff is gone and then apply a small amount of solder to the tip to make it shiny. On badly corroded irons, it may be necessary to first dress the tip with a



- DIMENSIONS ARE IN INCHES -

Technical drawing of a rectangular box with dimensions in inches. The drawing shows a perspective view of the box with a lid. The lid has two circular holes, one labeled $\frac{9}{16}$ DIA. and the other $\frac{7}{16}$ DIA. The box has a front face with three rectangular openings. Dimensions are given for the overall size, the lid, and the openings. A note at the top right states: "- DIMENSIONS ARE IN INCHES -".

Dimensions (in inches):

- Overall width: $2\frac{1}{8}$
- Overall height: $1\frac{15}{16}$
- Lid height: $\frac{3}{4}$
- Lid hole diameters: $\frac{9}{16}$ DIA. and $\frac{7}{16}$ DIA.
- Box height: $\frac{7}{16}$
- Box width: $2\frac{1}{8}$
- Box depth: $1\frac{5}{16}$
- Box opening width: $\frac{5}{16}$
- Box opening height: $\frac{15}{16}$
- Box opening depth: $\frac{5}{16}$

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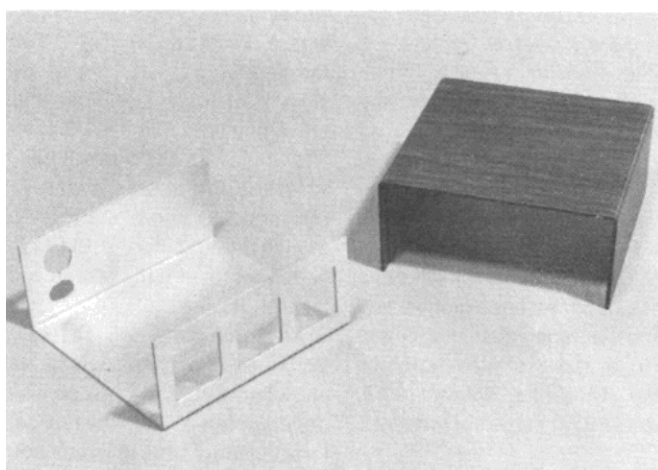


Photo 5. Remove remaining masking tape and wash reservoir with alcohol. Your completed enclosure should look like this.

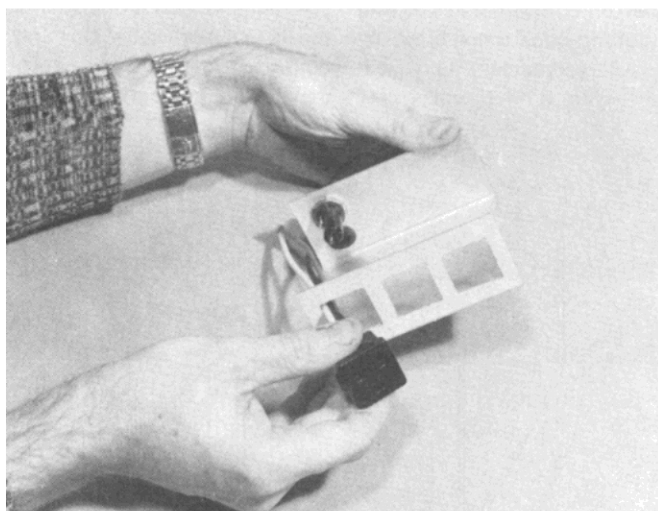


Photo 6. Install rubber grommet, line cord, fuse holder, and receptacles with grounding plug, facing downward to allow adequate clearance for most popular 110V plug styles.

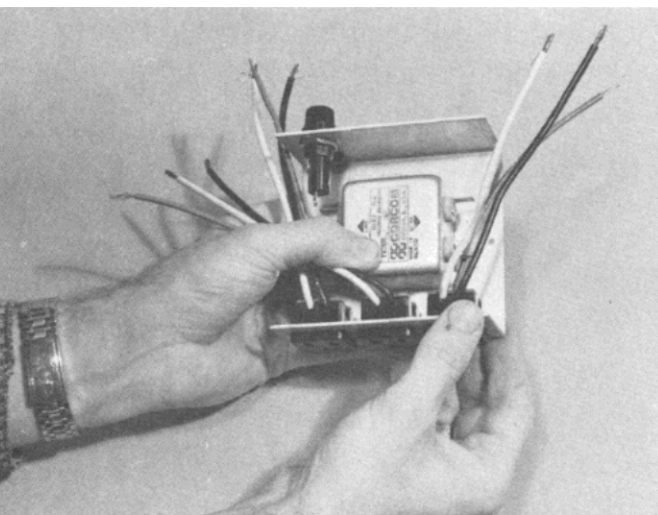


Photo 7. Position the RFI filter to provide adequate clearance between components. Mark location, drill holes, and mount filter. Due to their low profile, use of pop rivets is recommended to minimize the possibility of scratching the surface the filter is sitting on.

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file. Once your iron is ready, the secret to soldering is to heat the work piece and then let the work piece melt the solder.

Cut and strip all the #18 gauge hook-up wires to length and apply a bit of solder to each bare end. This is called tinning the wire, making it much easier to solder the connection. Be sure to put a knot in the power code, or apply some other form of strain relief, or you will eventually jerk some of your connections loose.

After making all connections, inspect your work, looking for

cold solder joints or misconnections. When you are sure everything is correct, put the cover on the box and you're ready to plug the system into the wall.

A powerline filter will not guarantee protection from all transients. A direct hit of a lightning bolt, for example, will probably fry your refrigerator, washer, and dryer as well as your computer and the filter itself. However, given any distance, the filter will reduce problems by a substantial margin. It's a case of an ounce of prevention being worth a pound of cure. ■

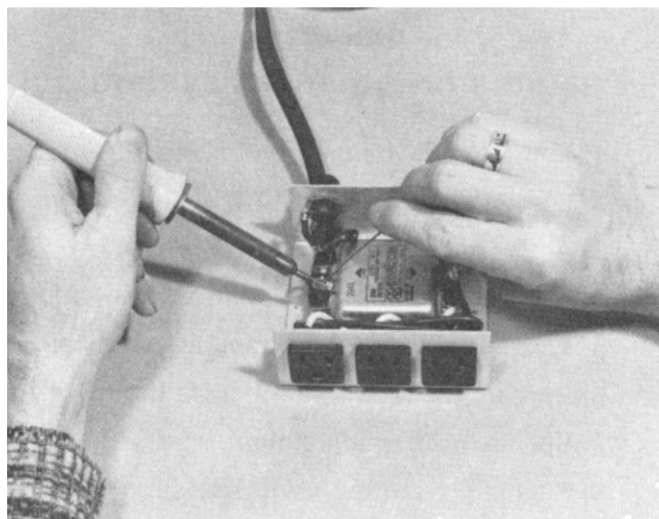


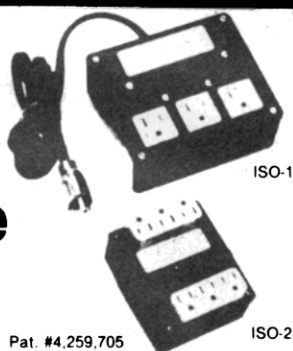
Photo 8. Cut receptacle wires to length and solder in place. Ensure proper polarity between the line cord and the receptacles. This can be most easily accomplished by plugging the line cord's plug into one of the receptacles and checking for continuity between one side of the RFI filter and one side of the line cord. Each side of the line cord should be soldered to the side of the RFI filter that shows continuity for that wire.

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Photo 9. Fasten brackets to chassis. These will be used to hold the top cover in place. (Photos continue on next page.)

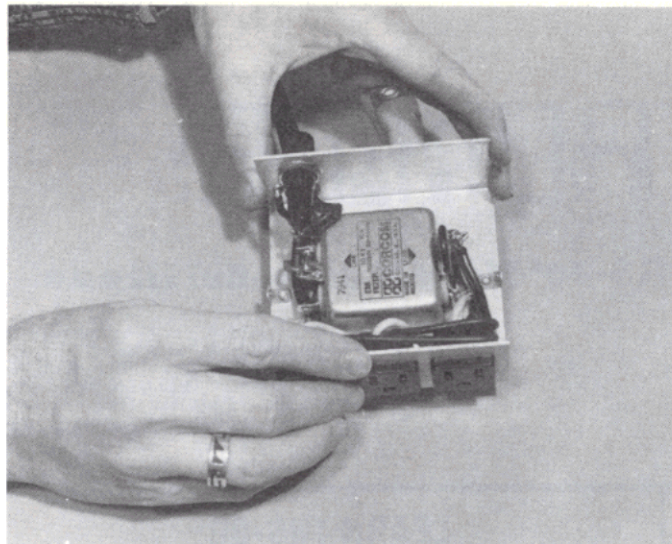


Photo 10. Your finished chassis should look like this.

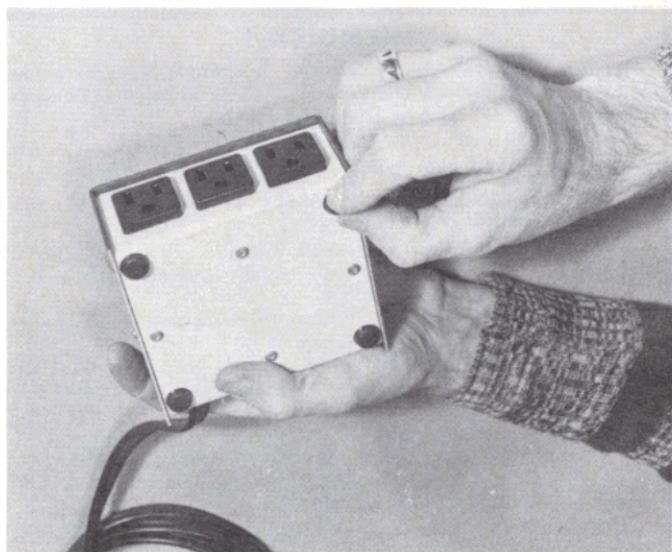


Photo 11. Fasten top cover to chassis and install rubber feet.

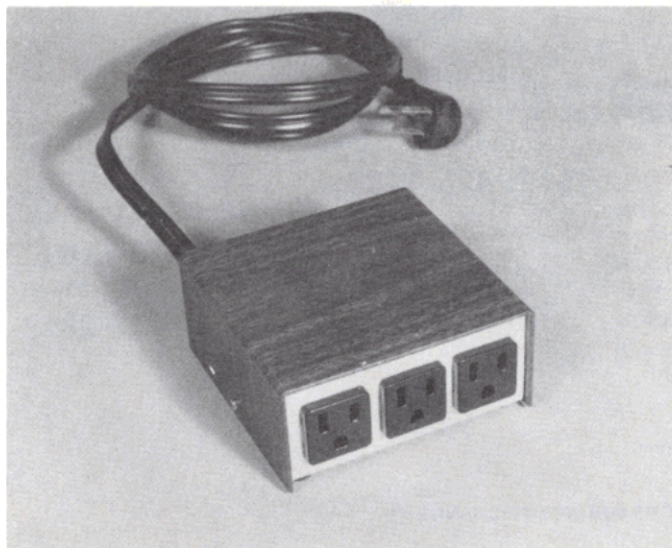


Photo 12. Install fuse in fuseholder and you're ready!

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(13) **ELECTRIC PENCIL** (Michael Shryer Software)... Complete word processor with extensive editing and printer formatting features... \$275 (Standard printer version). \$300 (DIABLO, NEC or QUME version).

(14) **BASIC COMPILER** (Microsoft)... changes your source programs into machine language... increases program execution by 3-10 times. \$395.

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20. RATE OF RETURN-CONSTANT INFLOW
21. REGULAR WITHDRAWAL FROM INVESTMENT
22. STRAIGHT LINE DEPRECIATION
23. SUM OF DIGITS DEPRECIATION
24. DECLINING BALANCE DEPRECIATION
25. BREAK EVEN ANALYSIS
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1 RULE78	Interest Apportionment by Rule of the 78's
2 ANNU1	Annuity computation program
3 DATE	Time between dates
4 DAYYEAR	Day of year a particular date falls on
5 LEASEINT	Interest rate on lease
6 BREAKEVN	Breakeven analysis
7 DEPRSL	Straightline depreciation
8 DEPRSY	Sum of the digits depreciation
9 DEPRDB	Declining balance depreciation
10 DEPRDDB	Double declining balance depreciation
11 TAXDEP	Cash flow vs. depreciation tables
12 CHECK2	Prints NEBS checks along with daily register
13 CHECKBK1	Checkbook maintenance program
14 MORTGAGE/A	Mortgage amortization table
15 MULTMON	Computes time needed for money to double, triple, etc.
16 SALVAGE	Determines salvage value of an investment
17 RRVARIN	Rate of return on investment with variable inflows
18 RRCONST	Rate of return on investment with constant inflows
19 EFFECT	Effective interest rate of a loan
20 FVAL	Future value of an investment (compound interest)
21 PVAL	Present value of a future amount
22 LOANPAY	Amount of payment on a loan
23 REGWITH	Equal withdrawals from investment to leave 0 over
24 SIMPDISK	Simple discount analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.
26 ANNUDEF	Present value of deferred annuities
27 MARKUP	% Markup analysis for items
28 SINKFUND	Sinking fund amortization program
29 BONDVAL	Value of a bond
30 DEPLETE	Depletion analysis
31 BLACKSH	Black Scholes options analysis
32 STOCVAL1	Expected return on stock via discounts dividends
33 WARVAL	Value of a warrant
34 BONDVAL2	Value of a bond
35 EPSEST	Estimate of future earnings per share for company
36 BETAALPH	Computes alpha and beta variables for stock
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold
38 OPTWRITE	Option writing computations
39 RTVAL	Value of a right
40 EXPVAL	Expected value analysis
41 BAYES	Bayesian decisions
42 VALPRINF	Value of perfect information
43 VALADINF	Value of additional information
44 UTILITY	Derives utility function
45 SIMPLEX	Linear programming solution by simplex method
46 TRANS	Transportation method for linear programming
47 EOQ	Economic order quantity inventory model
48 QUEUE1	Single server queueing (waiting line) model
49 CVP	Cost-volume-profit analysis
50 CONDPFOT	Conditional profit tables
51 OPTLOSS	Opportunity loss tables
52 FQOQ	Fixed quantity economic order quantity model

NAME

DESCRIPTION

53 FQEQWSH	As above but with shortages permitted
54 FQEQQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability Index of a project
58 CAP1	Cap. Asset Pr. Model analysis of project

59 WACC	Weighted average cost of capital
60 COMBAL	True rate on loan with compensating bal. required
61 DISCBAL	True rate on discounted loan
62 MERGANAL	Merger analysis computations
63 FINRAT	Financial ratios for a firm
64 NPV	Net present value of project
65 PRINDLAS	Laspeyres price index
66 PRINDPA	Paasche price index
67 SEASIND	Constructs seasonal quantity indices for company
68 TIMETR	Time series analysis linear trend
69 TIMEMOV	Time series analysis moving average trend
70 FUFRINF	Future price estimation with inflation
71 MAILPAC	Mailing list system
72 LETWRT	Letter writing system-links with MAILPAC
73 SORT3	Sorts list of names
74 LABEL1	Shipping label maker
75 LABEL2	Name label maker
76 BUSBJD	DOVE business bookkeeping system
77 TIMECLK	Computes weeks total hours from timeclock info.
78 ACCTPAY	In memory accounts payable system-storage permitted
79 INVOICE	Generate invoice on screen and print on printer
80 INVENT2	In memory inventory control system
81 TELDIR	Computerized telephone directory
82 TIMJAN	Time use analysis
83 ASSIGN	Use of assignment algorithm for optimal job assign
84 ACCTREC	In memory accounts receivable system-storage ok
85 TERMSPAY	Compares 3 methods of repayment of loans
86 PAYNET	Computes gross pay required for given net
87 SELLPR	Computes selling price for given after tax amount
88 ARBCOMP	Arbitrage computations
89 DEPRSF	Sinking fund depreciation
90 UPSZONE	Finds UPS zones from zip code
91 ENVELOPE	Types envelope including return address
92 AUTOEXP	Automobile expense analysis
93 INSFILE	Insurance policy file
94 PAYROLL2	In memory payroll system
95 DILANAL	Dilution analysis
96 LOANAFD	Loan amount a borrower can afford
97 RENTPRCH	Purchase price for rental property
98 SALELEAS	Sale-leaseback analysis
99 RRCONVBD	Investor's rate of return on convertible bond
100 PORTVAL9	Stock market portfolio storage-valuation program

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1. **S.B.S.G.** is a sophisticated Business Software System designed for the serious businessman.
2. Each of the **S.B.S.G. Business Modules** may be purchased separately...or you may purchase the entire coordinated business system.
3. Modules purchased separately do not coordinate with the General Ledger (although for the standard **S.B.S.G.** fee, the user may upgrade his individual modules for the coordinated system).
4. Foolproof, Step-By-Step procedures are supplied, planned and documented for the **First-Time Computer User**. All programs are self-explanatory, telling the user what is required at every step.
5. Programs are written in **BASIC** and the source code listing is supplied for those users who decide to modify the original system.
6. A complete users manual is supplied with each module.
7. Demo Data diskettes are supplied with sample data.
8. **S.B.S.G.** has an In-House staff that can answer questions and problems related to the proper use of the **S.B.S.G. Business System** (on the telephone or through the mail).
9. First-Time Computer Owners Note-Instructions are provided for entering state payroll withholding tables. There is an additional charge if you prefer to have **S.B.S.G. Programmers** insert the correct data.
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12. Minimum system requirement is 4-drives to run the extended coordinated system (AR-AP-GL-PR and INVENTORY/INVOICING).
13. The **A. OSBORNE & ASSOCIATES** business manuals are provided **FREE** with each order (they may be purchased separately at \$20 per manual).
14. The **INVENTORY** and **INVOICING** modules are original programs written by **S.B.S.G.**
15. Each module can be purchased as independent modules to run on a 2 or more drive system except **INVOICING**.
16. Memory requirement is 48K for the MODEL-I and 64K for the MODEL-II.
17. All **S.B.S.G. BUSINESS SYSTEMS** may be upgraded up to 4-disk drives. No data is ever lost during an upgrade. There is a standard **S.B.S.G.** charge for all upgrades.

ACCOUNTS PAYABLE

The accounts payable system receives data concerning purchases from suppliers and produces checks in payment of outstanding invoices. In addition, it produces cash management reports. This system aids in tight financial control over all cash disbursements of the business. Several reports are available and supply information needed for the analysis of payments, expenses, purchases and cash requirements. All A/P data feeds General Ledger so that data is entered into the system just once. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding many larger systems).

CAPABILITIES:

- ★ menu driven; easy to use; full screen prompting and cursor control
- ★ invoice oriented; everything revolves around the invoice; handles new invoice or credit memo or debit memo
- ★ invoice information recorded; invoice #, description, buyer, check register #, invoice date, age date, amount of invoice, discount (in %), freight, tax (\$), total payable
- ★ transaction print and file maintenance procedures insure accuracy
- ★ flexible check calculation procedure; allows checks to be calculated for a set of vendors-or-for specific vendors
- ★ program prints your checks; contiguous computer checks with your company letterhead can be purchased from SBSG
- ★ reports include (samples on back):
 - open item listing/closed item listing - both detail and summary
 - debit memo listing/credit memo listing
 - aging
 - check register report (to give an audit trail of checks printed)
 - vendor listing and vendor activity (activity of the whole year)
- ★ fully linked to GENERAL LEDGER; each invoice can be distributed to as many as five (5) different GL accounts; system automatically posts to cash and A/P accounts

ACCOUNTS RECEIVABLE

The objective of a computerized A/R system is to prepare accurate and timely monthly statements to credit customers. Management can generate information required to control the amount of credit extended and the collection of money owed in order to maximize profitable credit sales while minimizing losses from bad debts. The programs composing this system were developed 5 years ago, especially for small businesses using the Wang Microcomputer. They have been tested in many environments since then. Each module can be used stand alone or can feed General Ledger for a fully integrated system.

CAPABILITIES:

- ★ menu driven; easy to use; full screen prompting and cursor control
- ★ invoice oriented; invoices can be entered before ready for billing, when ready for billing, after billing or after paid
- ★ allows entry of new invoice, credit memo, debit memo, or change/delete invoice
- ★ allows for progress payment
- ★ transaction information includes:
 - type of A/R transaction
 - customer P.O. #
 - description of P.O.
 - shipping/transportation charges
 - tax charges
 - payment
 - progress payment information
 - transaction print & file maintenance procedures insure accuracy
- ★ customer statements printed; computer statements with your company letterhead can be purchased from SBSG
- ★ reports include: (samples on back)
 - listing of invoices not yet billed
 - open items (unpaid invoices)
 - closed items (paid invoices)
 - aging
- ★ fully linked to General Ledger; will post to applicable accounts; debit A/R, credits account you specify

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PAYROLL

Payroll invoices many complex calculations and the production of reports and documents, many of which are required by government agencies. It is an ideal candidate for the computer. With this Payroll system in-house, you can promptly and accurately pay your employees and generate accurate documents/reports to management, employees, and appropriate government agencies concerning earnings, taxes, and other deductions. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive, micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- ★ performs all necessary payroll tasks including:
 - file maintenance, pay data entry and verification
 - computation of pay and deduction amounts
 - printing of reports and checks
- ★ can handle salaried and hourly employees
- ★ employees can receive:
 - hourly or salary wage
 - vacation pay
 - holiday pay
 - piecework pay
 - overtime pay
- ★ employees can be paid using any combination of pay types (except, hourly cannot receive salary and salary cannot receive hourly)
- ★ special non-taxable or taxable lump sums can be paid regularly or one time (bonus, reimbursements, etc)
- ★ health and welfare deductions can be automatically calculated for each employee
- ★ earnings-to-date are accumulated and added to permanent records; taxes are computed and deducted: US income tax, Social Security tax, state income tax, other deductions (regular or one time)
- ★ paychecks are printed; computer checks with your company letter-head can be purchased from SBSG
- ★ calculations are accumulated for; employee pay history, 941A report, W-2 report, insurance report, absentee report
- ★ fully linked to General Ledger. Each employee's payroll information can be distributed to as many as (12) twelve different GL accounts; system automatically posts to cash account

INVENTORY CONTROL/INVOICING

- ★ **ISAM** (Indexed Sequential Access Method) eliminates the necessity for time consuming sort.
- ★ Pre-Allocated Files for IMMEDIATE update and inquiry capabilities.
- ★ Fast Disk storage and retrieval.
- ★ Inventory Master Record includes...class...SKU...Division...Retail...Cost...Beginning Balance...Period Sale Units...Period Receipts...On Order...On Hand...Minimum Reorder Point...Recommended Reorder Amount...Vendor Number...Period Sale Dollars...YTD Sale Units...YTD Sale Dollars.
- ★ Calculated and Displayed Formulas include...Gross Margin (\$)...Gross Margin (%)...Gross Margin ROI (%)...Average Inventory Retail (\$)...Average Inventory Cost (\$)...Turn-Over (%).
- ★ Reports Generated include...Master File Listing...Class Description Listing...Transaction Audit Trail...Minimum Reorder Point by Vendor...Retail Price List...Retail & Cost Price List...Period Sales Report...Year to Date Sales Report...Stock Status (Screen or printer output)...Commission Report (for salesmen and buyers).
- ★ Transaction Types include...Sales, Vendor Receipts...Vendor Orders...Customer Returns...Vendor Returns...Transfer Stock.

GENERAL LEDGER

The General Ledger accounting system consolidates financial data from other accounting subsystems (A/R, A/P, Payroll, direct posting) in an accurate and timely manner. Major reports include the Income Statement and Balance Sheet and a "special" report designed by management. The beauty of this General Ledger system is that it is completely user formatted. You "customize" the account numbers, descriptions, and report formats to suit particular business requirements. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- ★ more than 200 chart of accounts can be handled
- ★ account number structure is user defined and controlled
- ★ more than 1,750 transactions may be entered via:
 - direct posting; done by hand; validated against the account file before acceptance
 - external posting; generated by A/R, A/P, Payroll or any other user source
- ★ data is maintained and reported by:
 - month
 - quarter
 - year
 - previous three quarters
- ★ reports (samples on back) include:
 - trial balances
 - income statement
 - balance sheet
 - special accounts reports and more....
- ★ user formats reports with the following designated as you wish:
 - titles
 - headings
 - account numbers
 - descriptions
 - subtotals
 - totals
 - skip lines
 - skip pages
- ★ up to eight levels of totals - fully user designated
- ★ menu driven; easy to use; full screen prompting and cursor control

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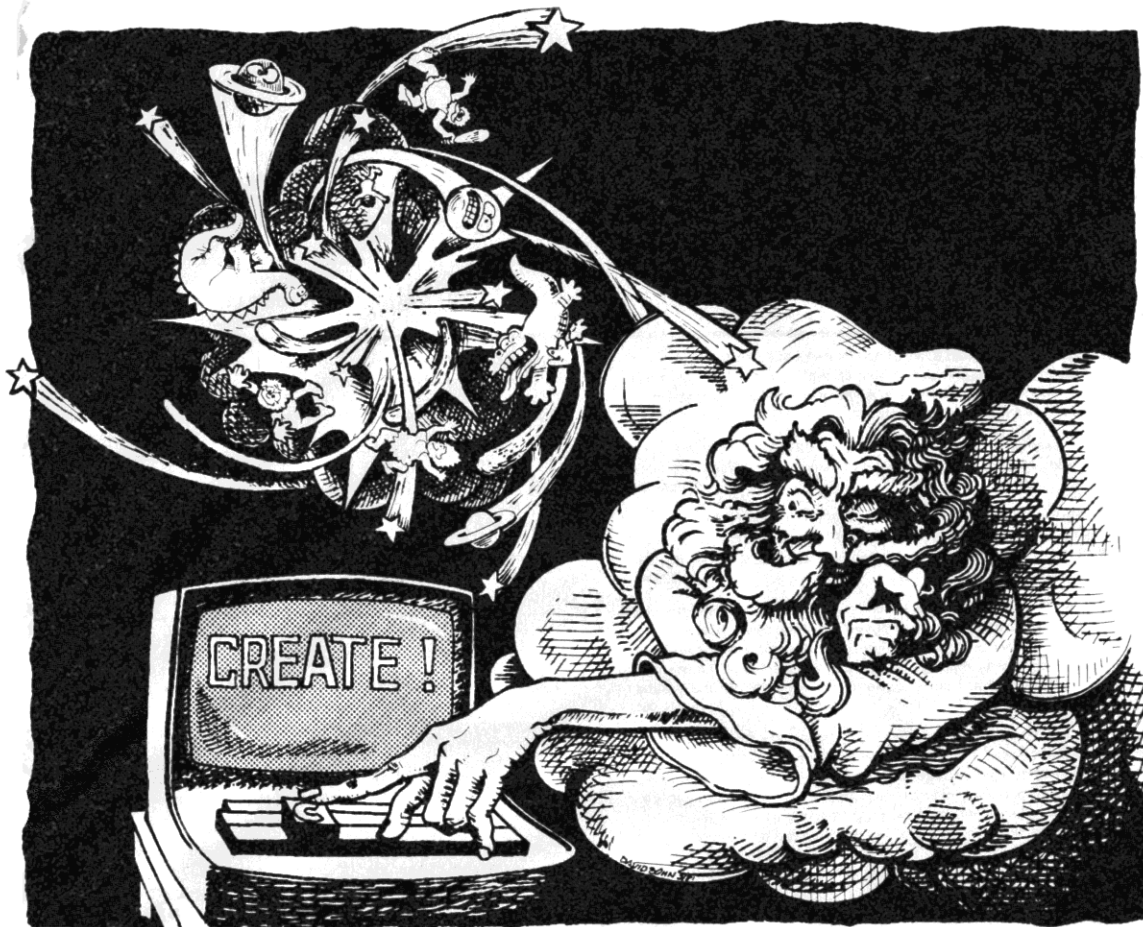
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RETurn. Moving along in the disassembly, I finally found the call which displays the ready message.

With this in mind, let me now tell you exactly what I'm doing in the program. I plug a JUMP to the starting address of my patch into DOS vector 41ACH so that control will pass to my patch (see Program Listing 1) during a restart. Lines 10 and 20 of the listing are two unknown calls that I encountered during the disassembly. They must be put here because I'm going to pass them up in ROM. Lines 30 and 40 display the new ready message. Line 50 pops the return address

to oblivion in order to balance the stack (I will JUMP back, not RETurn). Line 60 jumps back to ROM at the instruction immediately following the one which displays ready. Line 70 reserves memory to hold your new message. As you can see, I skip over the built-in prompt almost every time that it's displayed.

In order to make the initialization program a bit easier to use (and a lot easier to write) I wrote it in BASIC (see Program Listing 2). Lines 10 and 20 ask you for your new message. Lines 30 and 40 poke the patch into high memory. Lines 50 thru 90 poke

your new message, letter by letter, into the storage area allocated after the program. Notice that 64 bytes are allocated, while you are limited to a 62 character message. That's because the last two bytes must be 0DH (carriage return, line feed), 00H (end of message indicator). Line 100 takes care of this. Lines 110 and 120 put the patch address into the DOS vector address. Line 130 clears the screen so you get the full impact of your new message the very first time it's displayed!

The Problem

As I said earlier, this patch unfortunately has no effect after a CLOAD. This is because CLOAD is the one function which does not re-enter BASIC at the usual place. Instead, the ready message is printed inside of the CLOAD subroutine and control is then passed to a later point in the restart procedure, totally bypassing this patch. Considering how infrequently CLOAD is used (one CLOAD and your program is in memory), I don't think it's worth the memory you'd use to patch the message into the CLOAD subroutine. But if you're curious and would like to try, let me briefly explain how I would attempt to do it.

The Fix

The end of CLOAD is a JUMP to location 1AE8H. As it turns out, there is a DOS vector at 1AECB calling 41B5H. I think you could patch a routine here which would move the cursor up

Have you ever wished you could change your computer's tired, worn-out ready message into something with a little more life? If so, this program is for you! It will enable your computer to display anything you want in place of its built-in ready. Unfortunately, there is one slight problem. The new message that you choose will not be displayed after a CLOAD. That will be the only time you'll have to suffer with the old message. I'll explain why a little later.

How It Works

The concept for this program is really quite simple. According to the TBUG manual, the basic warm-start re-entry point is 1A19H. After doing some disassembly from that point on, I found a DOS vector call at 1A1CH. This is a call to 41ACH, which contains nothing but a

```
10 CALL 01F8H ; ROM CALL
20 CALL 20F9H ; ROM CALL
30 LD HL,7FC0H ; POINT TO NEW MESSAGE
40 CALL 28E1H ; PRINT MESSAGE
50 POP HL ; BALANCE STACK
60 JP 1A2BH ; JUMP BACK TO ROM
70 DEFS 64 ; SPACE FOR MESSAGE
```

Program Listing 1.

```
1 REM ***** NEW READY *****
2 REM BY RON BALEWSKI
10 CLS:PRINT@276,"NEW READY":PRINT"YOUR MESSAGE (UP TO 62 CHARACTERS)":INPUT$
20 IF LEN(A$)>62 THEN GOTO 10
30 FOR K=32688 TO 32703:READD:POKEK,D:NEXTK
40 DATA 205,248,1,205,249,32,33,192,127,205,167,40,225,1
50 K=32704
60 FOR J=1 TO LEN(A$)
70 POKEK,ASC(MID$(A$,J,1))
80 K=K+1
90 NEXT J
100 POKEK,13:POKEK+1,0
110 K=16812
120 POKEK,195:POKEK+1,176:POKEK+2,127
130 CLS
140 END
```

Program Listing 2.

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a line, print the new message, and return, thereby overwriting the ready. I haven't tried this, but it's a possibility. One method that I did try was to insert the BASIC line:

125 K = 16821:POKE K,195:
POKE K + 1,176: POKE K + 2,127

This line causes the above mentioned vector to jump to the new ready patch, thereby printing the new message and jumping to the beginning of the restart procedure. This method seems to work to an extent. I have the standard ready on one line with the new message on the line below it.

Yes, Your Majesty

In order to use the program, CLOAD and RUN and tell it what your new message will be. If you want a comma in the message string, be sure to enclose the entire message in double quotes when you type it in. This is because the program uses an input statement to accept your new message.

The program, as written, will

sit at the very top of a 16K machine. It's not relocatable because of the message pointer. To move this program somewhere else you'll have to change the values of the pokes as well as the eighth and/or ninth numbers in the data statement to show the starting location of the new message. It shouldn't be too difficult. For example, if you wanted to use this program at the top of a 4K machine, you would change the FOR statement in line 30 to:

FOR K = 20400T020415

You would also change the 127 in line 40 to 79 and the 32704 in line 50 to 20416. Everything else is the same. Oh yes, be sure to set the memory size accordingly (32688 as the program now stands) or things won't function right.

I think you'll find the new ready patch a very amusing program. I've received some very puzzled looks when someone sees my computer displaying "Yes, Your Majesty." ■

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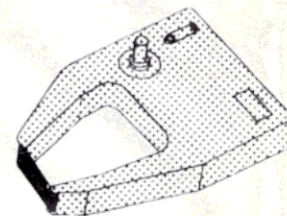
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Every Level II owner worth his salt has by now bought a monitor program like RSM2, Monbug or T-Bug. Any of these fine programs make it tempting to dig around in the Level II ROM to see how it works.

The first thing that you acquire from your searching about is a profound respect for the ROM authors. It's obvious that every byte does plenty of work.

Discoveries

Sooner or later, while cruising through ROM land in your monitor, a lot of familiar road signs will flash past. Pull over to the side of the road near &1660 and have a closer look. Well, for goodness sake! There are all those familiar BASIC words like Run, List and Stop. It must be

some sort of look-up table.

And look! There are some other English words hiding in the jumble. There's Merge... and Put... and Open. Wonder what they're there for? Get back into the monitor and let's head for RAM.

As we move through reserved RAM, we pass sign posts all pointing to the same place. There must be 20 or 30 in all, and each one says JP &012D. They're all bunched together near &4170. It must be a popular spot: Let's jump to 8012D and see why it's such an attraction.

Just a hick town, this &012D. A jump there results in this message to the screen—L3 Error. The Level II Manual says this about L3 Error: "Disk Basic only:

```
10 DEF FN RAD(R) = (3.14159/180)*R
```

```
100 X = COS (FN RAD(W))
```

Degree to Radian Conversion Functions

Fig. 1

An attempt was made to use a statement, function or command which is available only when the TRS-80 Mini Disk is connected via the Expansion Interface."

Gosh, I guess you need about \$1000 to visit all those exotic L3 destinations. Well, I probably didn't want to go there anyway!

One day a stranger appeared on the shelves at the local Tandy store. No black jacket this! It's a manual with a rich brown jacket and it's called *TRSDOS & Disk Basic Reference Manual* (Catalog No. 26-2104).

A brief reading reveals that all those strange English words in the Level II ROM near &1660 are Disk Basic words available only to those rich enough to afford all that extra gear.

Digging for Answers

The Level II ROM is a pretty complex can of worms. There's a lot to learn about how it all fits together. If I live long enough it may all become clear.

With the use of a monitor, ROM can be unraveled a small bit at a time. A few things are now obvious:

- The Level II BASIC interpreter can recognize Disk BASIC words.

- While the interpreter recognizes the words it cannot implement them. It's just not quite smart enough. You might say it knows the words... but not the music!

- Most Disk BASIC words result in a jump to &012D via the links near &4170. Thus, an L3 Error results.

A bit more effort and most the mystery is solved. Table 1 shows what goes where. Each of these links is a jump: there are 28 of them. Twenty-four are accessed by a Disk BASIC word. The other four are reached from a particular point in ROM.

We've now established that RAM, from &4152 to &41A5, is reserved for Disk BASIC jump links.

Let's look a little further. There's also a pattern in RAM from &41A6 to &41E4. Dividing this area into three-byte lumps, we notice that each lump starts with a &C9 (hex for the op code RETURN).

This type of three-byte lump looks like it's a link for a Call from somewhere in ROM. The

(Note: In the text, numbers prefixed with & are in hexadecimal notation)

Call has simply been short-circuited with a RETurn. The three-byte lump could be replaced with JP nn (which is three bytes long). In that way we could link new code into a particular spot

in ROM. As long as the new code ends with a RETurn, we'll go right back to the calling routine in ROM.

An investigation of the Call links ultimately gives us Table 2.

Disk BASIC Word Links

RAM ADDRESS	LVL II CONTENTS	LINK FOR	JUMP FROM
&4152	JP &012D	CVI	T*
&4155	"	FN	&2524
&4158	"	CVS	T
&415B	"	DEF	T
&415E	"	CVD	T
&4161	"	EOF	T
&4164	"	LOC	T
&4167	"	LOF	T
&416A	"	MKS\$	T
&416D	"	MKS\$	T
&4170	"	MKD\$	T
&4173	"	CMD	T
&4176	"	TIMES	&2510
&4179	"	OPEN	T
&417C	"	FIELD	T
&417F	"	GET	T
&4182	"	PUT	T
&4185	"	CLOSE	T
&4188	"	LOAD	T
&418B	"	MERGE	T
&418E	"	NAME	T
&4191	"	KILL	T
&4194	"	&	&24C8
&4197	"	LSET	T
&419A	"	RSET	T
&419D	"	INSTR	&2506
&41A0	"	SAVE	T
&41A3	"	LINE	T

JP &012D implements 'L3 ERROR'

*T = JUMP from BASIC word look-up table. Can be reached from Keyboard or from Program.

Table 1

Other Disk BASIC Links

RAM ADDRESS	LVL II CONTENTS	LINK WITH	CALLED FROM
&41A6	RET nn	ERROR	&19EC
&41A9	"	USR	&27FE
&41AC	"	READY	&1A1C
&41AF	"	KB INPUT	&0368
&41B2	"	BASIC INPUT	&1AA1
&41B5	"	"	&1AEC
&41B8	"	"	&1AF2
&41BB	"	NEW/END	&1B8C and &1DB0
&41BE	"	VDU SELECT	&2174
&41C1	"	OUTPUT TO DEVICE	&032C
&41C4	"	KB SCAN	&0358
&41C7	"	RUN	&1EA6
&41CA	"	PRINT	&206F
&41CD	"	—	&20C6
&41D0	"	CRLF	&2103
&41D3	"	TAB	&2108 and &2141
&41D6	"	COMMAND "INPUT"	&219E
&41D9	"	—	&2AEC
&41DC	"	READ	&222D
&41DF	"	READ/LIST	&2278 and &2B44
&41E2	RET nn	SYSTEM	&02B2

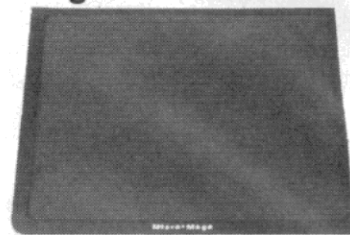
RET nn = 'Dead End' with room for JUMP or CALL instruction

Table 2

for the TRS-80 from Micro-Mega

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29



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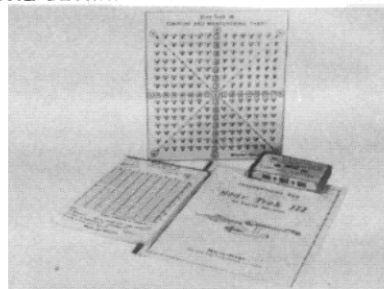
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Of the 21 links, 18 are each called from only one place in ROM. Three are called from two places. The column in Table 2 headed Link with is a bit suspect. That's because I haven't yet positively figured out what ROM is up to when the calls are given. When you work them out

for certain, let me know!

So What?

A fair question. In my case, a study of these link tables started me on the road to a machine language program called Level II and 1/2. The source and object codes (called Twohaf) are repro-

duced in Program Listings 1 and 2. This short program (not much over 1K bytes) gives access to selected Disk BASIC commands. It also offers the ability to quickly renumber BASIC lines as you go along in a quite sophisticated way.

Finally, Twohaf provides a fa-

cility for appending one BASIC program to the end of another—concatenating BASIC programs.

The source of Twohaf was written using Tandy's EDTASM (version 1.2) on a 16K machine. Because of RAM limitations it had to be written in two separate parts. When the object code from both parts is put together, we have Level II and 1/2.

Like most of us, I have looked at many enhancement programs for the Level II TRS-80. Many are very elaborate and represent a lot of work. The trouble is that they take up too much room in RAM while providing a lot of functions that I personally never use. Furthermore, each enhancement is equipped with a multi-page manual that keeps getting misplaced.

It finally came time to make a list of things that would be useful enhancements for Level II for my applications.

The list was short:

1. Enable DEF FN (DEFine FuNction)
 2. Enable DEFUSR (DEFine USEr)
 3. Enable hexadecimal notation.
 4. Enable BASIC line renumbering.
 5. Enable appending one BASIC program to another.
- All these functions are around as parts of various enhancements on the market. No one utility that I have found offers them all.

DEF FN (DEFine FuNction)

This is perhaps the most useful Disk BASIC command for my kind of programming. It permits the programmer to define a numeric or string function. After definition, the function can be called one or many times in a program. The Disk BASIC manual (referenced earlier) explains DEF FN.

A sample of the use of DEF FN is shown in Fig. 1. Note that the variable used to define a function need not match the variable used when the function is called.

Remember that a function definition is not limited to one variable. It's also useful to realize that one function can be used within the definition of an-

Program Listing 1

```

00100 ; < TWOHAF > PART 1 V 1.2 800401
00100 ; < TWOHAF > PART 1 V 1.2 800401
00110 ; A TRS-80 LEVEL II BASIC ENHANCEMENT PROGRAM
00120 ;
00130 ; GIL SPENCER (VK2JK)
00140 ; BOX 300 / SPIT JUNCTION, NSW 2088
00150 ; AUSTRALIA
00160 ;
00170 ; THIS PROGRAM ENABLES THESE NEW BASIC FUNCTIONS -
00180 ; 1. DEF FN -DEFINE FUNCTION
00190 ; 2. DEFUSR -DEFINE USER
00200 ; 3. & -PREFIX FOR HEX NOTATION
00210 ; 4. LINE -LINE RENUMBERING COMMAND
00220 ; 5. MERGE -SET CONCATENATE PARTITION
00230 ; 6. RSET -RESET " PARTITIONS
00240 ;
00250 ; FOR DETAILS, SEE TANDY TRSDOS & DISK BASIC MANUAL
00260 ;
00270 ; THIS PROGRAM IS LOADED BEGINNING AT -
00280 ; ORG 42E9H ; (THE USUAL START OF BASIC)
00290 ;
00300 ; NOTE - ACTIVE PART IS PROTECTED BY RELOCATING THE
00310 ; USUAL START OF BASIC HIGHER IN MEMORY.
00320 ; THE INITIALIZATION ROUTINE IS OVERWRITTEN
00330 ; AFTER EXIT FROM TWOHAF.
00340 ;
42E9 3AAF40 AS5 LD A,(40AFH)
42EC 3D 00360 DEC A
42ED 3D 00370 DEC A
42EE 3D 00380 DEC A
42EF B7 00390 OR A
42F0 37 00400 SCF
42F1 CA5643 00410 JP Z,AS6
42F4 4E 00420 LD C,(HL)
42F5 23 00430 INC HL
42F6 46 00440 LD B,(HL)
42F7 C5 00450 PUSH BC
42F8 FA1343 00460 JP M,AS7
42FB 23 00470 INC HL
42FC 4E 00480 LD C,(HL)
42FD 23 00490 INC HL
42FE 46 00500 LD B,(HL)
42FF C5 00510 PUSH BC
4300 E21343 00520 JP PO,AS7
4303 23 00530 INC HL
4304 DA0A43 00540 JP C,AS8
4307 211D41 00550 LD HL,411DH
430A 4E 00560 AS8 LD C,(HL)
430B 23 00570 INC HL
430C 46 00580 LD B,(HL)
430D 23 00590 INC HL
430E C5 00600 PUSH BC
430F 4E 00610 LD C,(HL)
4310 23 00620 INC HL
4311 46 00630 LD B,(HL)
4312 C5 00640 PUSH BC
4313 DA6043 00650 AS7 JP C,AS9
4316 CF 00660 AS1 RST 8
4317 BE 00670 CP (HL)
4318 3E80 00680 LD A,80H
431A 32DC40 00690 LD (40DCH),A
431D B6 00700 OR (HL)
431E 47 00710 LD B,A
431F C31226 00720 JP 2612H
4322 CD1643 00730 ASC CALL AS1
4325 3AAF40 00740 LD A,(40AFH)
4328 B7 00750 OR A
4329 F5 00760 PUSH AF
432A 22F340 00770 LD (40F3H),HL
432D EB 00780 EX DE,HL
432E 7E 00790 LD A,(HL)
432F 23 00800 INC HL
4330 66 00810 LD H,(HL)
4331 6F 00820 LD L,A
4332 B4 00830 OR H
4333 CA4E44 00840 JP Z,AS2
4336 7E 00850 LD A,(HL)
4337 FE28 00860 CP 28H
4339 C28943 00870 JP NZ,AS3+1
433C D7 00880 RST 16
433D 22D840 00890 LD (40D8H),HL
4340 1802 00900 JR AS4

```

Program continues

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4342	CF	00910	AS10	RST	8
4343	2C	00920		INC	L
4344	0E04	00930	AS4	LD	C,04
4346	CD6319	00940		CALL	1963H
4349	3E80	00950		LD	A,80H
434B	32DC40	00960		LD	(40DCH),A
434E	CD0D26	00970		CALL	260DH
4351	EB	00980		EX	DE,HL
4352	37	00990		SCF	
4353	C3E942	01000	AS11	JP	AS5
4356	D22324	01010	AS6	JP	NC,2423H
4359	D5	01020		PUSH	DE
435A	EB	01030		EX	DE,HL
435B	CD8828	01040		CALL	2888H
435E	D1	01050		POP	DE
435F	AF	01060		XOR	A
4360	E5	01070	AS9	PUSH	HL
4361	F5	01080		PUSH	AF
4362	EB	01090		EX	DE,HL
4363	7E	01100		LD	A,(HL)
4364	FE29	01110		CP	29H
4366	20DA	01120		JR	NZ,AS10
4368	2AF340	01130		LD	HL,(40F3H)
436B	CF	01140		RST	8
436C	28E5	01150		JR	Z,AS11
436E	2AD840	01160		LD	HL,(40D8H)
4371	CD0D26	01170	AS13	CALL	260DH
4374	E3	01180		EX	(SP),HL
4375	CD2B1F	01190		CALL	1F2BH
4378	7E	01200		LD	A,(HL)
4379	FE29	01210		CP	29H
437B	2807	01220		JR	Z,AS12
437D	CF	01230		RST	8
437E	2C	01240		INC	L
437F	E3	01250		EX	(SP),HL
4380	CF	01260		RST	8
4381	2C	01270		INC	L
4382	18ED	01280		JR	AS13
4384	D7	01290	AS12	RST	16
4385	E3	01300		EX	(SP),HL
4386	CF	01310		RST	8
4387	29	01320		ADD	HL,HL
4388	3ED5	01330	AS3	LD	A,0D5H
438A	CF	01340		RST	8
438B	D5	01350		PUSH	DE
438C	CD3723	01360		CALL	2337H
438F	2B	01370		DEC	HL
4390	D7	01380		RST	16
4391	C29719	01390		JP	NZ,1997H
4394	E7	01400		RST	32
4395	282F	01410		JR	Z,AT1
4397	D1	01420	AT6	POP	DE
4398	F1	01430	AT4	POP	AF
4399	283F	01440		JR	Z,AT2
439B	301C	01450		JR	NC,AT3
439D	E1	01460		POP	HL
439E	C1	01470		POP	BC
439F	70	01480		LD	(HL),B
43A0	2B	01490		DEC	HL
43A1	71	01500		LD	(HL),C
43A2	FA9843	01510		JP	M,AT4
43A5	2B	01520		DEC	HL
43A6	C1	01530		POP	BC
43A7	70	01540		LD	(HL),B
43A8	2B	01550		DEC	HL
43A9	71	01560		LD	(HL),C
43AA	E29843	01570		JP	PO,AT4
43AD	2B	01580		DEC	HL
43AE	C1	01590		POP	BC
43AF	70	01600		LD	(HL),B
43B0	2B	01610		DEC	HL
43B1	71	01620		LD	(HL),C
43B2	2B	01630		DEC	HL
43B3	C1	01640		POP	BC
43B4	70	01650		LD	(HL),B
43B5	2B	01660		DEC	HL
43B6	71	01670		LD	(HL),C
43B7	18DF	01680		JR	AT4
43B9	D5	01690	AT3	PUSH	DE
43BA	F5	01700		PUSH	AF
43BB	E7	01710		RST	32
43BC	11D340	01720		LD	DE,40D3H
43BF	CD8828	01730		CALL	Z,2888H
43C2	F1	01740		POP	AF
43C3	C31A28	01750		JP	281AH
43C6	2AB340	01760	AT1	LD	HL,(40B3H)
43C9	EB	01770		EX	DE,HL
43CA	2A2141	01780		LD	HL,(4121H)
43CD	DF	01790		RST	24
43CE	3805	01800		JR	C,AT5
43D0	CD4328	01810		CALL	2843H
43D3	18C2	01820		JR	AT6
43D5	D1	01830	AT5	POP	DE
43D6	21D340	01840		LD	HL,40D3H
43D9	E5	01850		PUSH	HL
43DA	CD529	01860	AT2	CALL	29F5H
43DD	7E	01870		LD	A,(HL)
43DE	22B340	01880		LD	(40B3H),HL
43E1	E1	01890		POP	HL
43E2	77	01900		LD	(HL),A

Program continues

43E3 23	01910	INC	HL
43E4 71	01920	LD	(HL),C
43E5 23	01930	INC	HL
43E6 70	01940	LD	(HL),B
43E7 18AF	01950	JR	AT4
43E9 FEC1	01960 DEF	CP	0C1H
43EB 2852	01970	JR	Z,DE1
43ED CD1643	01980	CALL	AS1
43F0 CD2828	01990	CALL	2828H
43F3 EB	02000	EX	DE,HL
43F4 73	02010	LD	(HL),E
43F5 23	02020	INC	HL
43F6 72	02030	LD	(HL),D
43F7 EB	02040	EX	DE,HL
43F8 7E	02050	LD	A,(HL)
43F9 FE28	02060	CP	28H
43FB C2051F	02070	JP	NZ,1F05H
43FE D7	02080	RST	16
43FF CD0D26	02090 DE2	CALL	260DH
4402 7E	02100	LD	A,(HL)
4403 FE29	02110	CP	29H
4405 CA051F	02120	JP	Z,1F05H
4408 CF	02130	RST	8
4409 2C	02140	INC	L
440A C3FF43	02150	JP	DE2
440D F1	02160 USR	POP	AF
440E CD2D44	02170	CALL	US1
4411 D5	02180	PUSH	DE
4412 CD2C25	02190	CALL	252CH
4415 E3	02200	EX	(SP),HL
4416 4E	02210	LD	C,(HL)
4417 23	02220	INC	HL
4418 46	02230	LD	B,(HL)
4419 21E726	02240	LD	HL,26E7H
441C E5	02250	PUSH	HL
441D C5	02260	PUSH	BC
441E 3AAF40	02270	LD	A,(40AFH)
4421 F5	02280	PUSH	AF
4422 FE03	02290	CP	3
4424 CCDA29	02300	CALL	Z,29DAH
4427 F1	02310	POP	AF
4428 EB	02320	EX	DE,HL
4429 212141	02330	LD	HL,4121H
442C C9	02340	RET	
442D D7	02350 US1	RST	16
442E 010000	02360	LD	BC,0
4431 3005	02370	JR	NC,US2
4433 D630	02380	SUB	30H
4435 17	02390	RLA	
4436 4F	02400	LD	C,A
4437 D7	02410	RST	16
4438 EB	02420 US2	EX	DE,HL
4439 211F4A	02430	LD	HL,4A1FH
443C 09	02440	ADD	HL,BC
443D EB	02450	EX	DE,HL
443E C9	02460	RET	
443F CD2D44	02470 DE1	CALL	US1
4442 D5	02480	PUSH	DE
4443 CF	02490	RST	8
4444 D5	02500	PUSH	DE
4445 CD022B	02510	CALL	2B02H
4448 E3	02520	EX	(SP),HL
4449 73	02530	LD	(HL),E
444A 23	02540	INC	HL
444B 72	02550	LD	(HL),D
444C E1	02560	POP	HL
444D C9	02570	RET	
444E 1E2E	02580 AS2	LD	E,2EH
4450 C3A219	02590	JP	19A2H
4453 110000	02600 HEX	LD	DE,0
4456 D7	02610	RST	16
4457 2B	02620	DEC	HL
4458 0605	02630	LD	B,5
445A 23	02640 HX6	INC	HL
445B 7E	02650	LD	A,(HL)
445C CD3E1E	02660	CALL	1E3EH
445F EB	02670	EX	DE,HL
4460 300A	02680	JR	NC,HX3
4462 FE3A	02690	CP	3AH
4464 3019	02700	JR	NC,HX4
4466 D630	02710	SUB	30H
4468 3815	02720	JR	C,HX4
446A 1806	02730	JR	HX5
446C FE47	02740 HX3	CP	47H
446E 300F	02750	JR	NC,HX4
4470 D637	02760	SUB	37H
4472 29	02770 HX5	ADD	HL,HL
4473 29	02780	ADD	HL,HL
4474 29	02790	ADD	HL,HL
4475 29	02800	ADD	HL,HL
4476 B5	02810	OR	L
4477 6F	02820	LD	L,A
4478 05	02830	DEC	B
4479 CAB207	02840	JP	Z,07B2H
447C EB	02850	EX	DE,HL
447D 18DB	02860	JR	HX6
447F CD9A0A	02870 HX4	CALL	0A9AH
4482 EB	02880	EX	DE,HL
4483 C9	02890	RET	
4484 00	02900 LAST	DEFB	0
0000	02910	END	
00000	TOTAL ERRORS		

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other.

DEFUSR (DEFine USer)

Ten different USR routines (USR0 through USR9) can be defined. The purpose of DEFUSR is to tell the BASIC interpreter the start address of a machine language subroutine.

Values can be passed from

BASIC to USR and vice versa. Consult both the Level II BASIC manual and the Disk BASIC manual for the complete story.

Hexadecimal Notation

Disk BASIC offers you a way to use both hexadecimal and octal notation in addition to decimal notation. This is a great help to

the programmer. It avoids the errors made when code is available in hex (or octal) and needs to become part of a BASIC program (which requires decimal).

Level II and 1/2 skips the octal option. There just doesn't seem to be much demand for it, which simplifies matters. A number without a prefix is assumed to

be decimal. A number with an ampersand (&) prefix is assumed to be hexadecimal. Thus, in Level II and 1/2 the interpretation of these two statements is identical: 10 DEFUSR3 = 27648, 10 DEFUSR3 = &6C00. Level II and 1/2 does not support hex notation in data or input statements.

BASIC Line Renumbering

This is certainly one facility that every programmer wishes he had at his finger tips. A line renumberer should be easy to use; should be fast; should fix all pointers (GOTO, GOSUB, etc.); and should be flexible (variable start points, variable increments, etc.).

Level II and 1/2 offers all these advantages. About the only thing it does not do is change any reference to line numbers that you may have buried in REM statements.

The Disk BASIC word that activates the line renumbering routine in Level II and 1/2 is Line. Used by itself, it assumes these default values:

- New first line number = 10
- Renumber all lines
- Increment = 10

The Line command can control all three of these parameters. For example, LINE 1000, 500, 20 means: new first line number = 1000; start renumbering with old line number 500; increment = 20.

Such control is extremely handy when you need to insert a large block of numbers in the middle of a BASIC program to accommodate a new routine.

Default values and specific values can be mixed in the Line command. For example - LINE, 100 means: new first line number = 10; renumber all lines; increment = 100.

Concatenating BASIC Programs

In EDP the word Merge means to shuffle or blend together. Append or Concatenate is a subset of Merge, meaning place next to each other.

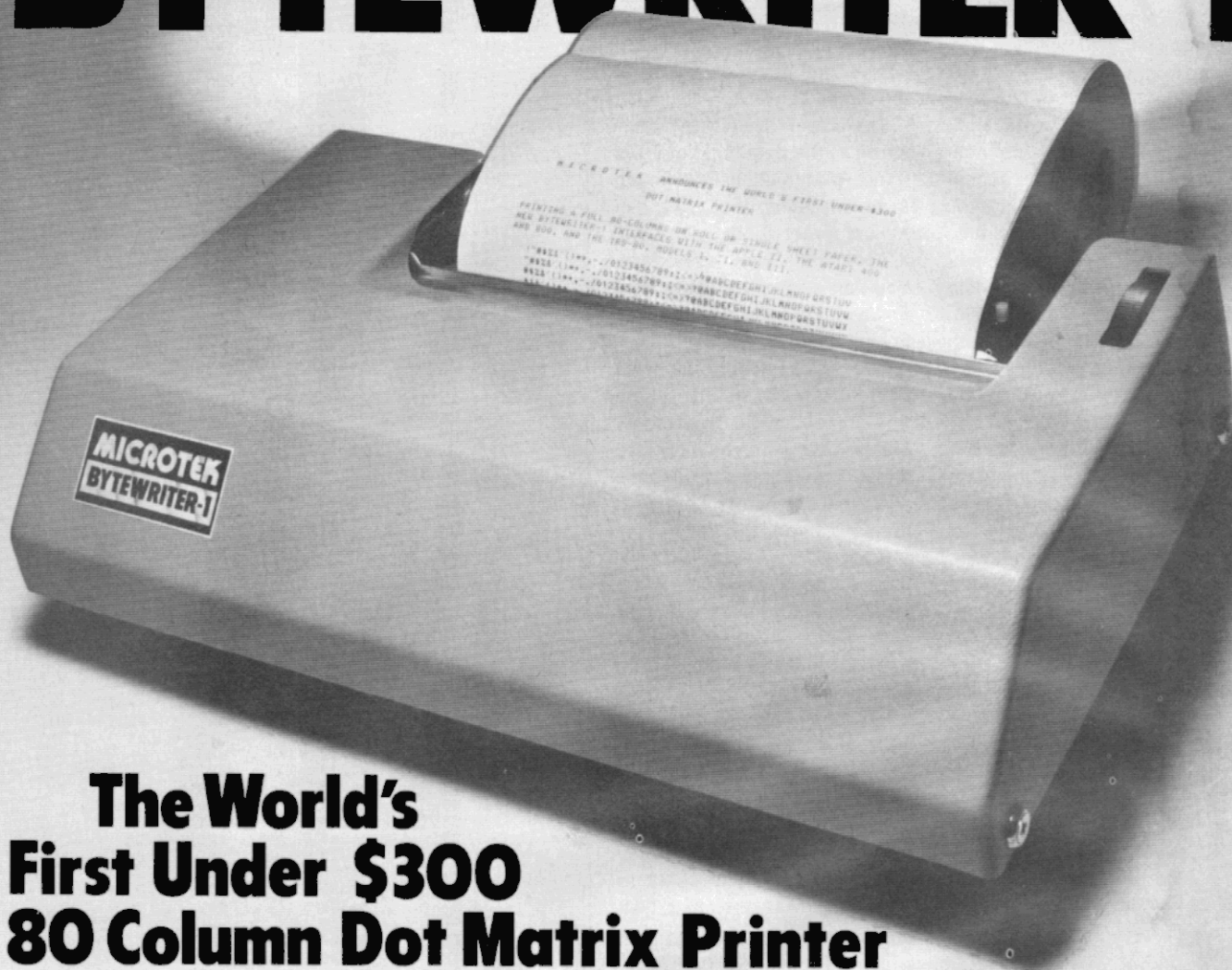
As the word Append is not in the Disk BASIC vocabulary, I had to settle for Merge. Here's how you use it: You have a BASIC program called John in RAM. John's highest line number is

Program Listing 2

```
02920 ; < TWOHAF > PART 2 V 1.2 800401
02930 ;
02940 ; GIL SPENCER (VK2JK)
02950 ; BOX 300 / SPIT JUNCTION, NSW 2088
02960 ; AUSTRALIA
02970 ;
02980 ; THE FOLLOWING LABELS, DEFINED IN PART 1, ARE NEEDED IN
02990 ; PART 2 -
4322 03000 ASC DEFL 4322H
43E9 03010 DEF DEFL 43E9H
440D 03020 USR DEFL 440DH
4453 03030 HEX DEFL 4453H
4484 03040 LAST DEFL 4484H
      03050 ;
4484 03060 ; ORG LAST ;CONNECT TO 1ST PART OF TWOHAF
      03070 ;
4484 CD611B 03080 LINE CALL 1B61H
4487 011E1D 03090 LD BC,1D1EH
448A 2B 03100 DEC HL
448B D7 03110 RST 16
448C C5 03120 PUSH BC
448D 010A00 03130 LD BC,000AH
4490 C5 03140 PUSH BC
4491 50 03150 LD D,B
4492 58 03160 LD E,B
4493 2826 03170 JR Z,NU1
4495 FE2C 03180 CP 2CH
4497 2809 03190 JR Z,NU2
4499 D5 03200 PUSH DE
449A CD4F1E 03210 CALL 1E4FH
449D 42 03220 LD B,D
449E 4B 03230 LD C,E
449F D1 03240 POP DE
44A0 2819 03250 JR Z,NU1
44A2 CF 03260 NU2 RST 8
44A3 2C 03270 INC L
44A4 CD4F1E 03280 CALL 1E4FH
44A7 2812 03290 JR Z,NU1
44A9 F1 03300 POP AF
44AA CF 03310 RST 8
44AB 2C 03320 INC L
44AC D5 03330 PUSH DE
44AD CD5A1E 03340 CALL 1E5AH
44B0 C29719 03350 JP NZ,1997H
44B3 7A 03360 LD A,D
44B4 B3 03370 OR E
44B5 CA4A1E 03380 JP Z,1E4AH
44B8 EB 03390 EX DE,HL
44B9 E3 03400 EX (SP),HL
44BA EB 03410 EX DE,HL
44BB C5 03420 NU1 PUSH BC
44BC EB 03430 EX DE,HL
44BD 22E545 03440 LD (NU0),HL
44C0 EB 03450 EX DE,HL
44C1 CD2C1B 03460 CALL 1B2CH
44C4 D1 03470 POP DE
44C5 D5 03480 PUSH DE
44C6 C5 03490 PUSH BC
44C7 CD2C1B 03500 CALL 1B2CH
44CA 60 03510 LD H,B
44CB 69 03520 LD L,C
44CC D1 03530 POP DE
44CD DF 03540 RST 24
44CE EB 03550 EX DE,HL
44CF DA4A1E 03560 JP C,1E4AH
44D2 D1 03570 POP DE
44D3 C1 03580 POP BC
44D4 F1 03590 POP AF
44D5 D5 03600 PUSH DE
44D6 180E 03610 JR NU3
44D8 09 03620 NU5 ADD HL,BC
44D9 DA4A1E 03630 JP C,1E4AH
44DC EB 03640 EX DE,HL
44DD E5 03650 PUSH HL
44DE 21F9FF 03660 LD HL,0FFF9H
44E1 DF 03670 RST 24
44E2 E1 03680 POP HL
44E3 DA4A1E 03690 JP C,1E4AH
44E6 D5 03700 NU3 PUSH DE
44E7 5E 03710 LD E,(HL)
```

Program continues

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990. You have another BASIC program called Les on cassette, and you want to add Les to the bottom end of John. In Level II and 1/2, simply enter the word Merge. The VDU will say OK. RAM is now apparently empty (like after New). CLOAD Les in the usual way. At this stage the line numbers of Les do not matter. After CLOAD it will appear as though only Les is in RAM. You can run it, change it, anything you like. You must renumber Les so that the lowest line number is higher than 990, which you can do quickly using the Level II and 1/2 Line command. The Line command will not affect John.

If you had a third program on cassette named Bruce that you want to add beneath Les, use the word Merge again. Then CLOAD Bruce and continue as with Les. Remember that Bruce must start at a higher line number than Les finished at.

When you've got all the pieces put together (and the only limit is how much available RAM you have), you're ready for the last command in the sequence, which is the Disk BASIC word RSET. When you enter RSET, the VDU will say OK. Now you've got one big BASIC program! Easy as that!

Details

You can add Level II and 1/2 to your arsenal in several ways.

- Use Listings 1 and 2. These listings have both the source code and the object code. If you have EDTASM I'd suggest you key the source into the EDTASM buffer. After all, you are sure to decide to improve it.

- If you don't have EDTASM, you can key in the object code using T-Bug or a similar utility. Use the two left-most columns of Listings 1 and 2. Be sure to get the right code in the right addresses.

- If you can't type (or don't want to) write to me and we can arrange either a trade or sale of a cassette version of the program.

After you have a copy of Level II and 1/2, it's easy to use. Load it into your Level II machine via System. The name is Twohaf. Hit the slant line command and everything's done. You're back

in BASIC with extra functions at your fingertips.

To remind you that the enhancement is in there, a message will be printed before each ready prompt. This is nice when you've got as many versions around as I have!

The Level II and 1/2 code starts at the beginning of Level II free RAM (&42E9). Positioning it here means that you can almost forget about it. All Level II commands work as always. You can even set memory size for machine language routines in high memory.

You do lose about 1100 bytes of free RAM. Of course, if you find yourself with the memory size query again, you'll have to reload Twohaf, as the links are all set back to normal Level II by the bootstrap.

Knowing how the links in Tables 1 and 2 work will spark other ideas for you. It's nice to have some extra commands available that you can give from the keyboard.

For example, it is not at all unusual for me to have RSM2 loaded in high memory (&6C00 and higher) while jumping back and forth between BASIC and machine language. It's easy enough to get from RSM2 to BASIC—G 1A19 does that. Getting back to RSM2 used to be a hassle. I have to first type System, then slant line, followed by 27648 (or is it 26748?). That's now all changed. Only six bytes did it. The beginning of RSM2 is &6C00 and fortunately it's also the entry point. So six bytes were added just before &6C00.

```
6BFA : 21 00 6C : LD HL,6C00
6BFD : 22 80 41 : LD (4180),HL
```

After the addition, RSM2 was re-recorded using: P 6BFA 7E00 6BFA. The result of this addition is to link RSM2 with the Disk BASIC word Get.

Now all that's needed from BASIC is to enter Get—and, presto, we're back in RSM2. The same approach can be used for your favorite monitor or other frequently needed machine language utility.

Now, if we could only speed up the baud rate of the cassette I/O, maybe we won't need disks after all. . . ■

44E8 7B	03720	LD	A,E
44E9 23	03730	INC	HL
44EA 56	03740	LD	D,(HL)
44EB B2	03750	OR	D
44EC EB	03760	EX	DE,HL
44ED D1	03770	POP	DE
44EE 2807	03780	JR	Z,NU4
44F0 7E	03790	LD	A,(HL)
44F1 23	03800	INC	HL
44F2 B6	03810	OR	(HL)
44F3 2B	03820	DEC	HL
44F4 EB	03830	EX	DE,HL
44F5 20E1	03840	JR	NZ,NU5
44F7 C5	03850	PUSH	BC
44F8 CD1846	03860	CALL	NZ0
44FB CD2345	03870	CALL	NU6+1
44FE 2AE545	03880	LD	HL,(NU0)
4501 EB	03890	EX	DE,HL
4502 CD2C1B	03900	CALL	1B2CH
4505 60	03910	LD	H,B
4506 69	03920	LD	L,C
4507 C1	03930	POP	BC
4508 D1	03940	POP	DE
4509 D5	03950	PUSH	DE
450A 5E	03960	LD	E,(HL)
450B 7B	03970	LD	A,E
450C 23	03980	INC	HL
450D 56	03990	LD	D,(HL)
450E B2	04000	OR	D
450F 280D	04010	JR	Z,NU7
4511 EB	04020	EX	DE,HL
4512 E3	04030	EX	(SP),HL
4513 EB	04040	EX	DE,HL
4514 23	04050	INC	HL
4515 73	04060	LD	(HL),E
4516 23	04070	INC	HL
4517 72	04080	LD	(HL),D
4518 EB	04090	EX	DE,HL
4519 09	04100	ADD	HL,BC
451A EB	04110	EX	DE,HL
451B E1	04120	POP	HL
451C 18EB	04130	JR	NU8
451E 01181A	04140	LD	BC,1A18H
4521 C5	04150	PUSH	BC
4522 FEF6	04160	CP	0F6H
4524 AF	04170	XOR	A
4525 32E745	04180	LD	(FB),A
4528 2AA440	04190	LD	HL,(40A4H)
452B 2B	04200	DEC	HL
452C 23	04210	INC	HL
452D 7E	04220	LD	A,(HL)
452E 23	04230	INC	HL
452F B6	04240	OR	(HL)
4530 C8	04250	RET	Z
4531 23	04260	INC	HL
4532 5E	04270	LD	E,(HL)
4533 23	04280	INC	HL
4534 56	04290	LD	D,(HL)
4535 D7	04300	RST	16
4536 B7	04310	OR	A
4537 28F3	04320	JR	Z,NU9
4539 4F	04330	LD	C,A
453A 3AE745	04340	LD	A,(FB)
453D B7	04350	OR	A
453E 79	04360	LD	A,C
453F 2857	04370	JR	Z,NW1
4541 FE9E	04380	CP	9EH
4543 2025	04390	JR	NZ,NW2
4545 D7	04400	RST	16
4546 FE8D	04410	CP	8DH
4548 20EC	04420	JR	NZ,NW3
454A D7	04430	RST	16
454B FE0E	04440	CP	0EH
454D 20E7	04450	JR	NZ,NW3
454F D5	04460	PUSH	DE
4550 CDPE45	04470	CALL	NW4
4553 7A	04480	LD	A,D
4554 B3	04490	OR	E
4555 201B	04500	JR	NZ,NW5
4557 E5	04510	PUSH	HL
4558 2AE845	04520	LD	HL,(FC)
455B 2B	04530	DEC	HL
455C 212000	04540	LD	HL,20H
455F 2B	04550	DEC	HL
4560 212000	04560	LD	HL,20H
4563 2B	04570	DEC	HL
4564 213000	04580	LD	HL,30H
4567 E1	04590	POP	HL
4568 182A	04600	JR	NW6
456A FE0E	04610	CP	0EH
456C 20C7	04620	JR	NZ,NW7
456E D5	04630	PUSH	DE
456F CDPE45	04640	CALL	NW4
4572 E5	04650	PUSH	HL
4573 CD2C1B	04660	CALL	1B2CH
4576 0B	04670	DEC	BC
4577 3E0D	04680	LD	A,0DH
4579 384B	04690	JR	C,NW8
457B CDF920	04700	CALL	20F9H
457E 21D645	04710	LD	HL,NW9
4581 D5	04720	PUSH	DE

Program continues

4582 CDA728	04730	CALL	28A7H
4585 E1	04740	POP	HL
4586 CDAF0F	04750	CALL	0FAFH
4589 C1	04760	POP	BC
458A CD0A46	04770	CALL	NX1
458D E1	04780	POP	HL
458E E5	04790	PUSH	HL
458F C5	04800	PUSH	BC
4590 CDA70F	04810	CALL	0FA7H
4593 E1	04820 NX6	POP	HL
4594 D1	04830 NW6	POP	DE
4595 2B	04840	DEC	HL
4596 189D	04850	JR	NW7
4598 FE0D	04860 NW1	CP	0DH
459A 2099	04870	JR	NZ,NW7
459C D5	04880	PUSH	DE
459D CDFE45	04890	CALL	NW4
45A0 EB	04900	EX	DE,HL
45A1 23	04910	INC	HL
45A2 23	04920	INC	HL
45A3 23	04930	INC	HL
45A4 4E	04940	LD	C, (HL)
45A5 23	04950	INC	HL
45A6 46	04960	LD	B, (HL)
45A7 EB	04970	EX	DE,HL
45A8 60	04980	LD	H,B
45A9 69	04990	LD	L,C
45AA CDEB46	05000	CALL	NX3
45AD EB	05010	EX	DE,HL
45AE 13	05020	INC	DE
45AF 2AE845	05030	LD	HL, (FC)
45B2 2B	05040	DEC	HL
45B3 2B	05050	DEC	HL
45B4 2B	05060	DEC	HL
45B5 0E05	05070	LD	C,5
45B7 1A	05080 NX5	LD	A, (DE)
45B8 B7	05090	OR	A
45B9 283B	05100	JR	Z,NX4
45BB 77	05110	LD	(HL),A
45BC 23	05120	INC	HL
45BD 13	05130	INC	DE
45BE 0D	05140	DEC	C
45BF 20F6	05150	JR	NZ,NX5
45C1 D1	05160 NX7	POP	DE
45C2 2B	05170	DEC	HL
45C3 C33545	05180	JP	NW7
45C6 219345	05190 NW8	LD	HL,NX6
45C9 E5	05200	PUSH	HL
45CA 2AE845	05210	LD	HL, (FC)
45CD E5	05220	PUSH	HL
45CE 2B	05230	DEC	HL
45CF 70	05240	LD	(HL),B
45D0 2B	05250	DEC	HL
45D1 71	05260	LD	(HL),C
45D2 2B	05270	DEC	HL
45D3 77	05280	LD	(HL),A
45D4 E1	05290	POP	HL
45D5 C9	05300	RET	
45D6 42	05310 NW9	DEFB	'BAD BRANCH TO '
45E4 00	05320	DEFB	0
0002	05330 NU0	DEFS	2
0001	05340 FB	DEFS	1
0002	05350 FC	DEFS	2
45EA B7B6	05360 FJ	DEFW	0B6B7H
45EC 9D9F	05370	DEFW	9F9DH
45EE C28E	05380 NX2	DEFW	8EC2H
45F0 B4B5	05390	DEFW	0B5B4H
45F2 8DCA	05400	DEFW	0CA8DH
45F4 9195	05410	DEFW	9591H
45F6 3620	05420 NX4	LD	(HL),20H
45F8 23	05430	INC	HL
45F9 0D	05440	DEC	C
45FA 20FA	05450	JR	NZ,NX4
45FC 18C3	05460	JR	NX7
45FE 23	05470 NW4	INC	HL
45FF 5E	05480	LD	E, (HL)
4600 23	05490	INC	HL
4601 56	05500	LD	D, (HL)
4602 23	05510	INC	HL
4603 22E845	05520	LD	(FC),HL
4606 2B	05530	DEC	HL
4607 C3781D	05540	JP	1D78H
460A D5	05550 NX1	PUSH	DE
460B C5	05560	PUSH	BC
460C 3E20	05570	LD	A,20H
460E 1E05	05580	LD	E,5
4610 0B	05590 NX8	DEC	BC
4611 02	05600	LD	(BC),A
4612 1D	05610	DEC	E
4613 20FB	05620	JR	NZ,NX8
4615 C1	05630	POP	BC
4616 D1	05640	POP	DE
4617 C9	05650	RET	
4618 2AA440	05660 NZ0	LD	HL, (40A4H)
461B 7E	05670 NZ2	LD	A, (HL)
461C 23	05680	INC	HL
461D B6	05690	OR	(HL)
461E 2838	05700	JR	Z,NZ1
4620 23	05710	INC	HL
4621 23	05720	INC	HL

Program continues

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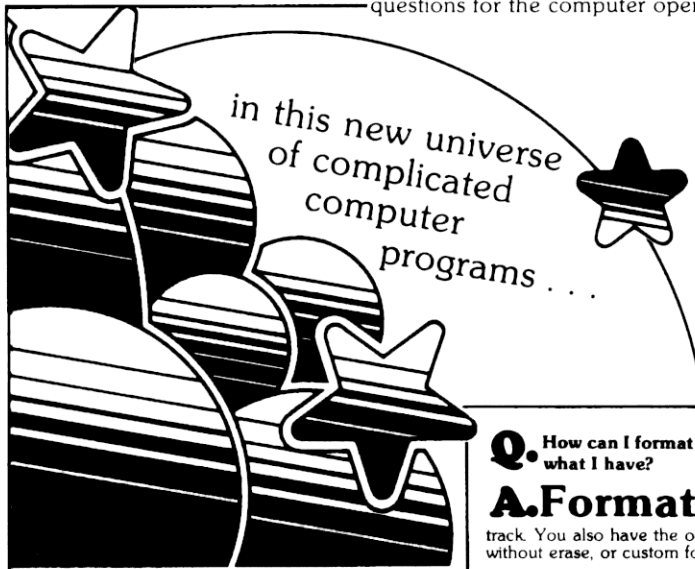
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4622 23	05730	INC	HL
4623 7E	05740	LD	A, (HL)
4624 B7	05750	OR	A
4625 23	05760	INC	HL
4626 28F3	05770	JR	Z, NZ2
4628 F22346	05780	JP	P, NZ3
462B 2B	05790	DEC	HL
462C 11EA45	05800	LD	DE, FJ
462F 0E0C	05810	LD	C, 0CH
4631 1A	05820	LD	A, (DE)
4632 BE	05830	CP	(HL)
4633 2845	05840	JR	Z, NZ4
4635 13	05850	INC	DE
4636 0D	05860	DEC	C
4637 20F8	05870	JR	NZ, NZ5
4639 7E	05880	LD	A, (HL)
463A FE89	05890	CP	89H
463C 23	05900	INC	HL
463D 20E4	05910	JR	NZ, NZ3
463F E5	05920	PUSH	HL
4640 2B	05930	DEC	HL
4641 D7	05940	RST	16
4642 FE23	05950	CP	23H
4644 200F	05960	JR	NZ, NZ6
4646 D7	05970	RST	16
4647 FEF3	05980	CP	0F3H
4649 200A	05990	JR	NZ, NZ6
464B D7	06000	RST	16
464C 2807	06010	JR	Z, NZ6
464E FE2C	06020	CP	2CH
4650 20F9	06030	JR	NZ, NZ7
4652 F1	06040	POP	AF
4653 1825	06050	JR	NZ4
4655 E1	06060	POP	HL
4656 18CB	06070	JR	NZ3
4658 2AA440	06080	LD	HL, (40A4H)
465B EB	06090	EX	DE, HL
465C 62	06100	LD	H, D
465D 6B	06110	LD	L, E
465E 7E	06120	LD	A, (HL)
465F 23	06130	INC	HL
4660 B6	06140	OR	(HL)
4661 2867	06150	JR	Z, NZ8
4663 23	06160	INC	HL
4664 23	06170	INC	HL
4665 23	06180	INC	HL
4666 7E	06190	LD	A, (HL)
4667 23	06200	INC	HL
4668 FE0E	06210	CP	0EH
466A 2809	06220	JR	Z, NZ9
466C B7	06230	OR	A
466D 20F7	06240	JR	NZ, NA1
466F EB	06250	EX	DE, HL
4670 73	06260	LD	(HL), E
4671 23	06270	INC	HL
4672 72	06280	LD	(HL), D
4673 18E7	06290	JR	NA2
4675 23	06300	INC	HL
4676 23	06310	INC	HL
4677 18ED	06320	JR	NA1
4679 2B	06330	DEC	HL
467A D7	06340	RST	16
467B E5	06350	PUSH	HL
467C CD5A1E	06360	CALL	1E5AH
467F C1	06370	POP	BC
4680 7D	06380	LD	A, L
4681 91	06390	SUB	C
4682 2824	06400	JR	Z, NA3
4684 D5	06410	PUSH	DE
4685 5F	06420	LD	E, A
4686 3E02	06430	LD	A, 2
4688 F5	06440	PUSH	AF
4689 3E05	06450	LD	A, 5
468B 93	06460	SUB	E
468C 3007	06470	JR	NC, NA4
468E 2F	06480	CPL	
468F 3C	06490	INC	A
4690 D1	06500	POP	DE
4691 C602	06510	ADD	A, 2
4693 F5	06520	PUSH	AF
4694 AF	06530	XOR	A
4695 C5	06540	PUSH	BC
4696 C4D446	06550	CALL	NZ, NA5
4699 E1	06560	POP	HL
469A 360E	06570	LD	(HL), 0EH
469C 23	06580	INC	HL
469D C1	06590	POP	BC
469E D1	06600	POP	DE
469F 73	06610	LD	(HL), E
46A0 23	06620	INC	HL
46A1 72	06630	LD	(HL), D
46A2 23	06640	INC	HL
46A3 3620	06650	LD	(HL), 20H
46A5 10FB	06660	DJNZ	NA6
46A7 23	06670	INC	HL
46A8 2B	06680	DEC	HL
46A9 D7	06690	RST	16
46AA 3C	06700	INC	A
46AB 3D	06710	DEC	A
46AC 38CB	06720	JR	C, NA7
46AE 23	06730	INC	HL

Program continues



How in heavens name, can **SUPER UTILITY** provide answers?

Super Utility is a powerful and sophisticated zapping program that allows you to go to the heart of the disk and read or modify data with ease, engaging simple one-key commands that threads through all of your logical decision choices. Super Utility, written by Kim Watt of Breeze Computing, Inc., is a stand alone program containing seven main menus, which are the answers to frustrated questions you have while struggling through your TRS-80 programs.

Q. Isn't there an easier way to examine and modify data?

A.Zap has an easy to read printout that reveals information in both HEX and ASCII and simultaneously moveable dual cursors. You can modify data using Hex, Decimal, ASCII or Binary input, and any changes are automatically updated on both sides of the readout. You can search through disk or file sectors, stopping anywhere to copy, compare and verify data on your disk.

Q. Isn't there an easier way to get rid of this data I don't want?

A.Purge enables you to clear a disk of unwanted data. Kill files by file-spec or have the computer list them one at a time for deletion.

Q. How can I format my disk without erasing what I have?

A.Format your disk and add tracks. Make a 35 track disk a 40 track. You also have the option of formatting with or without erase, or custom formatting your disk.

Q. This disk is protected. Isn't there some way I can copy it?

A.Disk Copy enables you to back up most TRS-80 readable disks, regardless of efforts to protect it. So, back up your original and back up your modified version, too, or...

A.Tape Copy if you wish to back up your tape.

Q. My disk won't boot. Now what do I do?

A.Disk Repair will recover killed files, if the file was accidentally killed by this utility. Repair GAT table, HIT table and Boot. Read protect directory track and check directory.

Q. How can I get more access to my memory?

A.Memory allows you to move, test, compare, zero, exchange edit, or jump to, memory. Load memory to/from disk and input or output a byte to any port.

You will love the simplicity and freedom of modifying programs to suit your needs. Now, the only question left is...

Q. How do I order?

A. Send check or money order for only \$49.95 plus \$2.50 shipping and handling to:

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Foreign orders, please add \$5.00 additional postage. Michigan residents add 4% sales tax.

Breeze Computing, Inc. will send every owner, upon registration of Super Utility, one back up copy. \$2.50.

DISCOVER THE 6809 IN YOUR COLOR COMPUTER

Now you can explore the Radio Shack Color Computer's impressive potentials—as an inexpensive development system, a color peripheral, a process controller—ad infinitum. The Micro Works introduces these powerful software tools for utilizing the color computer at the assembly language level.

MONITOR TAPE: A cassette tape which allows you to:

- Examine or change memory using a formatted hex display
- Save areas of memory to cassette in binary (a "CSAVEM")
- Download/upload data or programs to a host system
- Move the video display page throughout RAM
- Send or receive RS-232 at up to 9600 baud
- Investigate and activate features of your computer, such as hi-res graphics or machine-language music
- Use your color computer as an intelligent peripheral for another computer, a color display or a 6809 program development tool

The monitor has 19 commands in all, and is relocatable and re-entrant.

80C Monitor Tape Price: \$29.95

MONITOR ROM: The same program as the monitor tape, supplied on ROM. This allows BASIC to use the entire RAM space. And you don't need to re-load the monitor each time you use it. The ROM plugs into the Extended Basic ROM Socket or a modified ROMPACK.

80C Monitor ROM

Price: \$39.95

C BUG IS HERE!!

INSIDE THE COLOR COMPUTER: This package is a disassembler which runs on the color computer and enables you to generate your own source listing of the BASIC interpreter ROM. Also included is a documentation package which gives useful ROM entry points, complete memory map, I/O hardware details and more. Disassembler features include cross-referencing of variables and labels; output code which can be re-assembled; output to an 80-column printer, small printer or screen; and a data table area specification which defaults to the table boundaries in the interpreter ROM. A 16K system is required for the use of this cassette.

80C Disassembler Price: \$49.95

THE **MICRO WORKS** 109

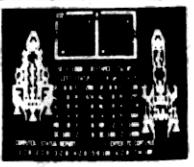
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46AF CA1B46	06740	JP	Z,NZ2
46B2 2B	06750	DEC	HL
46B3 FE20	06760	CP	20H
46B5 28F0	06770	JR	Z,NA8
46B7 FE2C	06780	CP	2CH
46B9 28EC	06790	JR	Z,NA8
46BB FECE	06800	CP	0CEH
46BD 28E8	06810	JR	Z,NA8
46BF FED4	06820	CP	0D4H
46C1 3804	06830	JR	C,NA9
46C3 FED7	06840	CP	0D7H
46C5 38E0	06850	JR	C,NA8
46C7 C32346	06860 NA9	JP	NZ3
46CA 2AF940	06870 NZ8	LD	HL,(40F9H)
46CD 22FB40	06880	LD	(40FBH),HL
46D0 22FD40	06890	LD	(40FDH),HL
46D3 C9	06900	RET	
46D4 E5	06910 NA5	PUSH	HL
46D5 2AF940	06920	LD	HL,(40F9H)
46D8 EB	06930	EX	DE,HL
46D9 2600	06940	LD	H,0
46DB 6F	06950	LD	L,A
46DC 19	06960	ADD	HL,DE
46DD 22F940	06970	LD	(40F9H),HL
46E0 44	06980	LD	B,H
46E1 4D	06990	LD	C,L
46E2 E1	07000	POP	HL
46E3 1A	07010 NB1	LD	A,(DE)
46E4 02	07020	LD	(BC),A
46E5 DF	07030	RST	24
46E6 C8	07040	RET	Z
46E7 1B	07050	DEC	DE
46E8 0B	07060	DEC	BC
46E9 18F8	07070	JR	NB1
46EB CD9A0A	07080 NX3	CALL	0A9AH
46EE AF	07090	XOR	A
46EF CD3410	07100	CALL	1034H
46F2 B6	07110	OR	(HL)
46F3 C3D90F	07120	JP	0FD9H
46F6 21FD46	07130 READY	LD	HL,G11
46F9 CDA728	07140	CALL	28A7H ;DISPLAY A STRING POINTED @ BY HL
46FC C9	07150	RET	
46FD 0B	07160 G11	DEFB	0BH
46FE 8785	07170	DEFW	8587H ;GRAPHICS CHARACTER
4700 4C	07180	DEFW	'LEVEL II-1/2 (V 1.2) IS -'
4719 00	07190	DEFW	0 ;NUL= END OF STRING FOR CALL 28A7
471A ED5BF940	07200 MERGE	LD	DE,(40F9H) ; () = END BASIC
471E 1B	07210	DEC	DE
471F D5	07220	PUSH	DE
4720 C1	07230	POP	BC
4721 1B	07240	DEC	DE
4722 1B	07250	DEC	DE
4723 1B	07260	DEC	DE
4724 1A	07270	LD	A,(DE)
4725 B7	07280	OR	A
4726 2005	07290	JR	NZ,ME2
4728 ED43F940	07300	LD	(40F9H),BC
472C 1B	07310	DEC	DE
472D 13	07320 ME2	INC	DE
472E 13	07330	INC	DE
472F ED53A440	07340	LD	(40A4H),DE
4733 214B47	07350	LD	HL,ME1 ; OK MESSAGE
4736 CDA728	07360	CALL	28A7H ; DISPLAY A STRING
4739 C3191A	07370	JP	1A19H ; JP TO BASIC
473C 215247	07380 RSET	LD	HL,TWOHAF
473F 22A440	07390	LD	(40A4H),HL ; RESET 'BASIC BEGIN'
4742 214B47	07400	LD	HL,ME1
4745 CDA728	07410	CALL	28A7H
4748 C3191A	07420	JP	1A19H
474B 3C	07430 ME1	DEFM	'< OK >'
4751 00	07440	DEFB	0
	07450 ;		
	07460 ; NOTE-		PROGRAM FROM HERE DOWN IS LOST WHEN JP TO BASIC
	07470 ;		IS DONE. IT IS ONLY NEEDED FOR INITIALIZATION.
	07480 ;		
4752 212243	07490 TWOHAF	LD	HL,ASC
4755 225641	07500	LD	(4156H),HL
4758 21E943	07510	LD	HL,DEF
475B 225C41	07520	LD	(415CH),HL ;LINK TO DISK BASIC 'DEF'
475E 215344	07530	LD	HL,HEX
4761 229541	07540	LD	(4195H),HL
4764 3EC3	07550	LD	A,0C3H ;'JP' FOR USR & READY
4766 32A941	07560	LD	(41A9H),A
4769 210D44	07570	LD	HL,USR ;LINK TO DISK BASIC 'USR'
476C 22AA41	07580	LD	(41AAH),HL
476F 218444	07590	LD	HL,LINE ;LINK TO DISK B. 'LINE'
4772 22A441	07600	LD	(41A4H),HL
4775 32AC41	07610	LD	(41ACH),A
4778 21F646	07620	LD	HL,READY
477B 22AD41	07630	LD	(41ADH),HL ;LINK WITH 'READY'
477E 211A47	07640	LD	HL,MERGE
4781 228C41	07650	LD	(418CH),HL ;LINK WITH D.B. 'MERGE'
4784 213C47	07660	LD	HL,RSET
4787 229B41	07670	LD	(419BH),HL ;LINK WITH D.B. 'RSET'
478A 215247	07680	LD	HL,TWOHAF
478D 22A440	07690	LD	(40A4H),HL ;LOAD NEW 'BASIC BEGIN'
4790 CD491B	07700	CALL	1B49H ;CALL LVL II 'NEW'
4793 C3191A	07710	JP	1A19H ;JP TO BASIC
4752	07720	END TWOHAF	
00000	TOTAL ERRORS		

Color computer owners, 32K PLUS DISKS*

\$298.⁰⁰

Yes, that's right - for as little as \$298.00 you can add 32K of dynamic RAM, and a disk interface, to your TRS-80 Color Computer! If you just want the extra memory it's only \$199.00, and you can add the disk interface later for \$99.00.

Just plug the *Color Computer Interface (CCI)*, from Exatron, into your expansion socket and "Hey Presto!" - an extra 32K of memory. No modifications are needed to your computer, so you don't void your Radio Shack warranty, and Exatron give both a 30 day money-back guarantee and full 1 year repair warranty on their interface.

The *CCI* also contains a 2K machine-language monitor, with which you can examine (and change) memory, set break-points, set memory to a constant and block-move memory.

So what about the *CCI Disk Card*? Well as we said it's only an extra \$99.00, but you'll probably want Exatron's *CCDOS* which is only \$29.95 - unless you want to write your own operating system. The *CCI Disk*

Card uses normal TRS-80 Model I type disk drives, and *CCDOS* will even load Model I TRSDOS disks into your color computer - so you can adapt existing TRS-80 BASIC programs.

As a further plus, with the optional *ROM Backup* adaptor, you can dump game cartridges to cassette or disk. Once the ROM cartridge is on cassette, or disk, you can reload, examine and modify the software. The *ROM Backup* adaptor is only \$19.95.

For more information, or to place an order, phone Exatron on their Hot Line 800-538 8559 (inside California 408-737 7111), or clip the coupon:



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PROGRAMMING TOOLS FOR YOUR TRS-80™

INSIDE LEVEL II

The Programmers Guide to the TRS-80 ROMS

INSIDE LEVEL II is a comprehensive reference guide to the Level II ROMs which allows the machine language or Basic programmer to easily utilize the sophisticated routines they contain. Concisely explains set-ups, calling sequences, and variable passage for number conversion, arithmetic operations, and mathematical functions, as well as keyboard, tape, and video routines. Part II presents an entirely new composite program structure which loads under the SYSTEM command and executes in both Basic and machine code with the speed and efficiency of a compiler. In addition, the 18 chapters include a large body of other information useful to the programmer including tape formats, RAM usage, relocation of Basic programs, USR call expansion, creating SYSTEM tapes of your own programs, interfacing of Basic variables directly with machine code, a method of greatly increasing the speed at which data elements are stored on tape, and special precautions for disk systems. **INSIDE LEVEL II** is a clearly organized reference manual. It is fully typeset and packed with nothing but useful information. It does not contain questions and answers, ROM dumps, or cartoons.

INSIDE LEVEL II.....\$15.95

SINGLE STEP THROUGH RAM OR ROM

STEP80 allows you to step through any Basic or machine language program one instruction at a time, and see the address, hexadecimal value, Zilog mnemonic, register contents, and step count for each instruction. The top 14 lines of the video screen are left unaltered so that the 'target program' may perform its display functions unobstructed. **STEP80** will follow program flow right into the ROMs, and is an invaluable aid in learning how the ROM routines function. Commands include step (trace), disassemble, run in step mode at variable step rate, display or alter memory or CPU registers, jump to memory location, execute a CALL, set breakpoints in RAM or ROM, write SYSTEM tapes, and relocate to any page in RAM. The display may also be routed to your line printer through the device control block so custom print drivers are automatically supported. **STEP80.....\$16.95**

TELECOMMUNICATIONS PROGRAM

This machine language program allows reliable high speed file transfers between two disk-based computers over modems or direct wire. It is menu driven and extremely simple to use. Functions include real-time terminal mode, save RAM buffer on disk, transmit disk file, receive binary files, examine and modify UART parameters, program 8 custom log-on messages, automatic 16-bit checksum verification of accurate transmission and reception, and many more user conveniences. Supports line printers and lowercase characters. With this program you will no longer need to convert machine language programs to ASCII for transmission, and you will know immediately if the transmission was accurate. **TELCOM.....\$29.95**

PROGRAM INDEX FOR DISK BASIC

Assemble an alphabetized index of your entire program library from disk directories. Program names and free space are read automatically (need not be typed in) and may be alphabetized with a fast Shell/Metzner sort by disk or program. The list may also be searched for any disk, program, or extension, disks or programs added or deleted, and the whole list or any part sent to the printer. Finally, the list itself may be stored on disk for future access and update. 'The best thing since sliced bread' (January issue of '80 Microcomputing). Works with TRSDOS, NEWDOS, and NEWDOS/80. One drive and 32K required. **INDEX.....\$19.95**

4 SPEED OPTIONS FOR YOUR TRS-80

The SK-2 clock modification allows CPU speeds to be switched between normal, an increase of 50%, or a 50% reduction; selectable at any time without interrupting execution or crashing the program. Instructions are also given for a 100% increase to 3.54 MHz, though the TRS-80 is not reliable at this speed. The SK-2 may be configured by the user to change speed with a toggle switch or on software command. It will automatically return to normal speed any time a disk is active, requires no change to the operating system, and has provisions for adding an LED to indicate when the computer is not at normal speed. It mounts inside the keyboard unit with only 4 necessary connections for the switch option (switch not included), and is easily removed if the computer ever needs service. The SK-2 comes fully assembled with socketed IC's and illustrated instructions. **SK-2.....\$24.95**

INSTANT ASSEMBLER

The **INSTANT ASSEMBLER** is a new, powerful tape-based editor/assembler and debugger for the TRS-80 Model II. It features immediate detection of errors as the source code is entered, assembly to memory as well as to tape, a built-in single-stepping debugger, a compactly coded source format that uses 1/3 as much memory as standard source, the ability to produce relocatable code modules, and the ability to link-load independently written modules. In addition, the **INSTANT ASSEMBLER** has many operational features including single stroke entry of DEFB and DEFW, continuous editing of successive lines, alphabetic listing of symbol table, separate commands for listing error lines or the symbol table, block move function, and verification of source tapes.

INSTANT ASSEMBLER includes three separate programs. The assembler itself includes the single-stepper and debugger. In this mode you may have full register displays, decimal or hex entry, forward or backward memory displays, disassembly of object code in memory, memory display in ASCII format, and hex-to-decimal or decimal-to-hex conversion. The single-stepper will step one instruction at a time or at a fast rate to any defined address. During assembly you may quickly switch from assembler to debugger and back again without losing the source code. This makes **INSTANT ASSEMBLER** an excellent learning tool for machine language programming. Also included on the tape are two versions of the linking loader which allow you to write your programs in smaller modules and link them together for final assembly.

INSTANT ASSEMBLER occupies 8375 bytes of memory. In a 16K machine this will leave you more than 7000 bytes which is enough to write assembly language programs of around 2000 bytes. This makes it ideal for users with only 16K machines. While this version was written specifically for tape systems, we will soon have a disk version as well. The instruction manual may be purchased separately for \$5, which will apply towards the purchase of the **INSTANT ASSEMBLER. INTASM.....\$29.95**

RAM SPOOLER AND PRINT FORMATTER

This program is a full feature print formatting package featuring user definable line and page length (with line feeds inserted between words or after punctuation), screen dump, printer pause control, and baud rate selection. In addition, printing is done from a 4K expandable buffer area so that the LPRINT or LLIST command returns control to the user while printing is being done. Ideal for Selectric or other slow printers. Allows printing and processing to run concurrently. Output may be directed to either the parallel port, serial port, or the video screen. **SPOOLER.....\$16.95**

MACHINE CODE FAST FOURIER TRANSFORM

This complete package includes 3 versions of the machine language FFTASM routine assembled for 16, 32, and 48K machines, a short sample Basic program to access them, a 10K Basic program which includes sophisticated interactive graphing and data manipulation, and a manual of instructions and examples. The machine language subroutines use variables defined by a supporting Basic program to make data entry and retrieval extremely fast and easy for custom implementation. They perform 20 to 40 times faster than their Basic equivalent (256 points in 12.5 seconds), and require less than 1550 bytes of memory. The FFT is useful in analyzing stock market and commodity trends as well as for scientific information. **FFTASM.....\$49.95**

DUPLICATE SYSTEM TAPES WITH CLONE

Make duplicate copies of any tape written for Level II. They may be SYSTEM tapes or data lists. The file name, load address, entry point, and every byte (in ASCII format) are displayed on the video screen. **CLONE.....\$16.95**

RAMTEST FOR LEVEL II

This machine language program is a very thorough test for several types of RAM errors. A complete test of each individual bit in a 48K machine takes just 14 seconds. Includes a separate test for power line glitches. **RAMTEST.....\$9.95**

EDIT BASIC PROGRAMS WITH ELECTRIC PENCIL

Load Basic programs or any other ASCII data file into the disk version of Electric Pencil for editing. One command from DOS quickly modifies existing files to Pencil format. One disk and 32K required. **PENPATCH.....\$9.95**

**MUMFORD
MICRO
SYSTEMS**

—144

ORDERING: Complete satisfaction is guaranteed or a full refund will be made. All programs are shipped on cassette unless \$5 is included for a formatted hard system disk. Include \$1 post age and handling. California residents add 6% sales tax. Visa, MasterCard, and COD orders accepted.

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A game for the refractionary.

The Level II Black Box

Morris Jones
533 Sutter St. #1206
San Francisco, CA 94102

When I tell you I have a Black Box for Level II BASIC, I'm not talking about a piece of hardware. Black Box is a game that tests your ability to find its contents.

Parker Brothers released Black Box last year as a game for two players. In their version, one player sets up the Black Box and the other plays detective. In this Level II program the computer sets up the Black Box and gives you the clues. You have the fun of digging into the box. Though the program does not keep score for two players, you can alternate at the keyboard and tally your own scores.

If you have played the Parker Brothers version you will find the computer a more devious opponent than a real person; people tend to use patterns, while BASIC is very random.

This Black Box is really an eight-unit by eight-unit square, much like a checker or chess board. The program hides three, four or five balls, or markers, in the box, and the object is to locate them by probing the box with imaginary rays. Only three conditions befall a ray: It may never leave the box; it may exit at a different location; or it may be reflected back out the same way it entered.

Imaginary Rays

A ray can enter the box in any of 32 places—eight squares on four sides. To launch a ray you must select one of the numbered locations. The ray advances one square at a time, until it leaves the box or hits a ball. If a ray hits a hidden ball, it will be

absorbed. The program then marks the entry point with an H. See Fig. 1. During the actual game you cannot see the path the ray follows, but only where it comes out—if it does.

As the ray advances, if it sees a ball that is ahead one square and one square to the left or right, it will be deflected 90 degrees away from the ball and leave the box at another point. (In other words, if the ball is

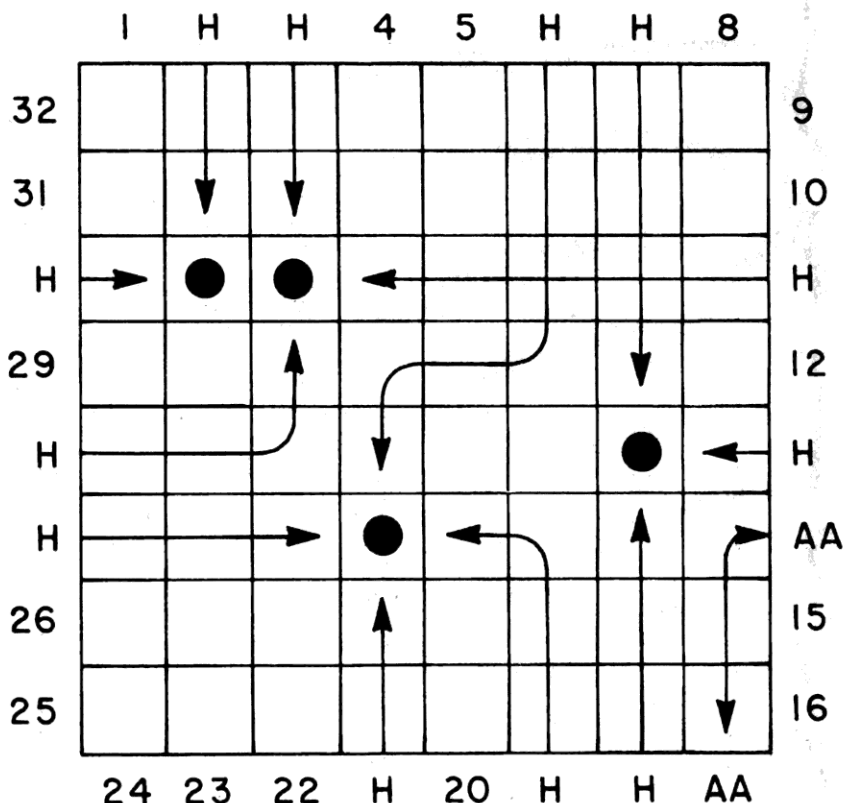


Fig. 1. Examples of hits: Two, three and seven are direct hits. Six, 19, and 28 are deflected hits. The program only marks the hit, not how the ray traveled. AA is an ordinary deflected ray for comparison.



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ahead left, the ray will turn right.) The program then marks the entry and exit points with two double letters. The first deflection will be marked AA at both entry and exit, the second, BB, and so forth.

A ray can be deflected several times before it leaves the box, or it may be deflected to land on a hit, in which case the program simply marks H without telling you that the ray was first deflected. The ray can also travel straight through to the opposite side without being deflected at all. See Fig. 2 for examples of deflections. Fig. 1 also shows

some deflected hits.

Now consider the special case in which a ray finds a ball ahead to the left and right. The ray can be deflected neither left nor right, and, instead, is reflected back toward the entry square. The ray exits from the same point it entered, and the program marks the point with an R.

One other special case causes a reflection. If the entry point you choose is directly to the left or right of a ball hidden on the edge, the ray will never have a chance to enter the board and be deflected, thus it is marked as a reflection. Examples of this special case and other reflections are illustrated in Fig. 3.

Stop and Score

The initial instructions give animated descriptions of what happens to a ray when it enters the box. During the game launch as many rays as you like, place guess balls, or remove them as often as you need to before you stop and score.

When you place a guess ball, the computer puts a graphic marker on your guess square. This is useful as a reference while you check your board. If you find that the ball is in the wrong place, remove it and

B(8,8) hidden ball array
G(8,8) guess array
N1(32) array of edge marker strings
N2(16) sets of double letters to use as markers
V1 video address
SC score
C "instructions in progress" flag
IM index for N2, N2(IM) is next marker to use
X1 entry point for ray
X2 exit point for ray
E direction vector

Table 1. Important Variables

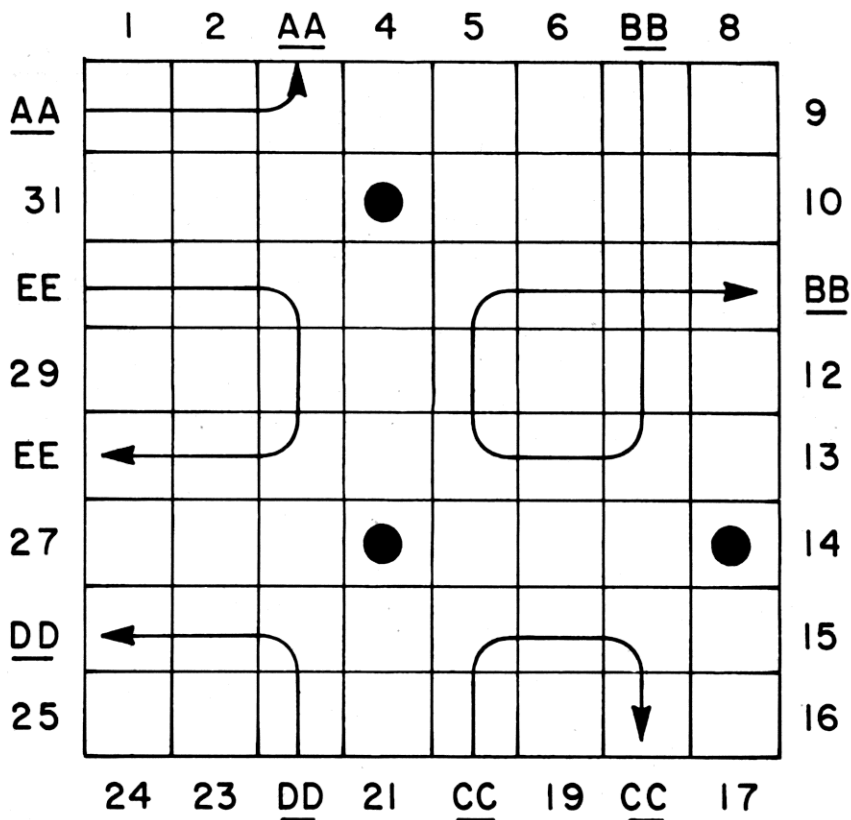


Fig. 2. Examples of deflected rays with markers at entry and exit. Notice that if you swap the entry point with the exit point, you achieve the same result—a deflection path will always produce one and only one pair of markers.

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"The final display of the board shows where the program hid the balls."

Lines 1000-1260 make up the stop and score routine. The routine first checks to see if you have made the right number of guesses and returns to the menu if you haven't. It then checks the guess array against the ball array and scores discrepancies. Lines 1050-1210 show graphically where wrong guesses and correct locations are. The final display of the board shows where the program hid the balls.

Lines 2000-2340 provide the move logic for the rays. Variable C is a flag, telling if the program is in the instruction sequence. If so, the ray movement is displayed. This can be useful for debugging the ray movement logic.

Lines 3000-3040 place a guess in the guess array.

Lines 4000-4040 remove a guess from the guess array.

Lines 5000-5020 redraw the board.

Lines 6000-6080 are used by the routines at 3000 and 4000. The routine displays the coordinate markers, accepts the input, and sets the values for the array subscripts in order to place or remove a guess ball.

Lines 7000-7070 complete the ray movement logic by setting or changing the values for the edge markers and printing them around the box.

Lines 8000-8420 are the instructions. With variable C set equal to -1, the instructions go back through the program and display graphically what happens to rays as they go through the box using an example. ■

Program Listing

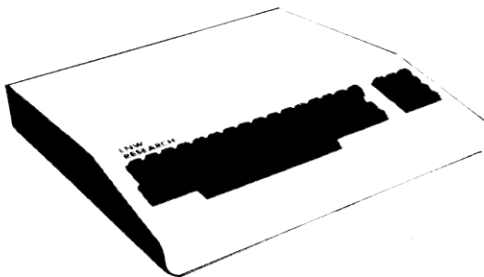
```

10 CLS
20 CLEAR200
30 DIM N1$(32),B$(8,8),N2$(16),G$(8,8),N3$(16)
40 DEFSTRN,Y:DEFINTA-M,O-X,Z
50 VI=15360:SC=0:IM=1:W=0
55 FORI=1TO8:FORJ=1TO8:B(I,J)=0:G(I,J)=0:NEXTJ,I
60 FORI=1TO32:N1(I)=RIGHT$(STR$(I),2):NEXT
70 FORI=1TO7:N2(I)=STRING$(2,CHR$(64+I)):NEXT:FORI=8TO16:N2(I)=S
  TRING$(2,CHR$(65+I)):NEXT
80 FORI=1TO8:N3(I)=STR$(I):NEXT:FORI=9TO16:N3(I)=CHR$(56+I)+" ":
  NEXT
85 IFCTHEN110
90 CLS:PRINT:PRINT"BLACK BOX VERSION 2.0":PRINT"BY MORRIS JONES"
  :PRINT:PRINT"DO YOU NEED INSTRUCTIONS? ";
95 Y=INKEY$:IFY=""THEN95
100 PRINTY:FORI=1TO200:NEXT:IFY="Y"THENC=-1:GOTO8000:ELSEIFY<>
  N"PRINTCHR$(08):GOTO95
110 C=0:CLS
500 FORVV=1TO8:FORHV=1TO8:D=VI+65+64*VV+3*HV:POKED,143:POKED+1,1
  43:NEXTHV,VV
510 FORI=1TO8:PRINT@65+3*I,N1(I):NEXT
520 FORI=9TO16:PRINT@156+64*(I-9),N1(I):NEXT
530 FORI=17TO24:PRINT@665-3*(I-17),N1(I):NEXT
540 FORI=25TO32:PRINT@577-64*(I-25),N1(I):NEXT
550 PRINT@99,"CHOOSE: ";PRINT@163,"DEGREE OF DIFFICULTY, ";:PRINT
  @227,"NUMBER OF BALLS (3-5) ";
560 H=VAL(INKEY$):IFH<3ORH>5THEN560ELSEPRINT@250,H;
570 FORI=1TOH
580 HV=RND(8):VV=RND(8)
590 IFB(HV,VV)THEN580ELSEB(HV,VV)=-1:NEXT
600 FORI=1TO700:NEXT
610 GOSUB8410
620 PRINT@99,"CHOOSE: ";PRINT@163,"1) STOP AND SCORE";:PRINT@227
  ,"2) LAUNCH RAY";:PRINT@291,"3) PLACE BALL GUESS";
630 PRINT@335,"4) REMOVE BALL GUESS";:PRINT@419,"5) REDRAW BOX";
  :PRINT@773,"POINTS USED: ";SC;
640 PRINT@803,STRING$(34," "):PRINT@803,"CHOICE? ";
650 X0=VAL(INKEY$):IFX0<1ORX0>5THEN650ELSEPRINTX0:FORI=1TO200:N
  EXT
660 ONX0GOTO1000,2000,3000,4000,5000
1000 FORI=1TO8:FORJ=1TO8:IFG(I,J)THENW=W+1:NEXTJ,I:ELSENEXTJ,I
  1010 IFW>HPRINT@803,"TOO MANY GUESSES";:W=0:FORI=1TO700:NEXT:GOT
  0610
1020 IFW<HPRINT@803,"NOT ENOUGH GUESSES";:W=0:FORI=1TO700:NEXT:G
  OT0610
1025 GOSUB8410:GI=-1
1030 FORI=1TO8:FORJ=1TO8
1040 IFG(I,J)ANDNOTB(I,J)THEND=VI+65+64*I+3*J:GI=0:ELSE1140
1050 PRINT@803,STRING$(29," "):PRINT@803,"WRONG GUESS";

```

Program continues

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1060 FORL=1TO5
1070 POKED,143:POKED+1,143:FORK=1TO250:NEXT
1080 POKED,133:POKED+1,138:FORK=1TO250:NEXT
1090 NEXTL
1100 POKED,143:POKED+1,143:SC=SC+5
1110 PRINT@773,"POINTS USED:";SC;
1120 NEXTJ,I
1130 GOTO1220
1140 IFB(I,J)ANDNOTG(I,J)THEND=VI+65+64*I+3*JELSE1210
1150 PRINT@803,STRING$(29," ");:PRINT@803,"CORRECT LOCATION";
1160 FORL=1TO5
1170 POKED,133:POKED+1,138:FORK=1TO250:NEXT
1180 POKED,143:POKED+1,143:FORK=1TO250:NEXT
1190 NEXT
1200 POKED,133:POKED+1,138
1210 NEXTJ,I
1220 GOSUB8410:IFGIPRINT@739,"ALL CORRECT";
1230 PRINT@803,"PLAY AGAIN? ";
1240 Y0=INKEY$:IFY0=""THEN1240
1250 IFY0="N"THENPRINTY0:END
1255 IFY0<>"Y"THEN1240:ELSEPRINTY0;:FORI=1TO200:NEXT
1260 CLS:C=-1:GOTO50
2000 GOSUB8410:PRINT@99,"LAUNCH RAY";:PRINT@227,"0 RETURNS TO ME
NU";:PRINT@803,STRING$(28," ");:PRINT@803,"CHOOSE VECTOR (01-32)?
";
2010 Y0=INKEY$:IFY0=""THEN2010ELSEIFASC(Y0)>47ANDASC(Y0)<58PRINT
Y0;:ELSE2010
2015 Y1=INKEY$:IFY1=""THEN2015ELSEIFY1=CHR$(08)PRINTY1;:GOTO2010
ELSEIFASC(Y1)=13THENY1=""GOTO2025:ELSEIFASC(Y1)>47ANDASC(Y1)<58
PRINTY1;ELSE2015
2020 Y=INKEY$:IFY=""THEN2020ELSEIFY=CHR$(08)PRINTY;:GOTO2015
2025 X1=VAL(Y0+Y1):IFX1=0THEN610ELSEIFX1>32THEN2000
2030 IFX1<9THENE=1:HV=1:VV=X1:GOTO2070
2040 IFX1<17ANDX1>8THENE=2:HV=X1-8:VV=8:GOTO2070
2050 IFX1<25ANDX1>16THENE=3:HV=8:VV=-X1+25:GOTO2070
2060 E=4:HV=-X1+33:VV=1
2070 IFB(HV,VV)THEN7010
2080 IFE=1ORE=3IFVV<>1IFB(HV,VV-1)THEN7000
2090 IFE=1ORE=3IFVV<>8IFB(HV,VV+1)THEN7000
2100 IFE=2ORE=4IFHV<>1IFB(HV-1,VV)THEN7000
2110 IFE=2ORE=4IFHV<>8IFB(HV+1,VV)THEN7000
2120 IFCTHEND=VI+65+64*HV+3*VV:POKED,133:POKED+1,138:FORI=1TO100
:NEXT:POKED,143:POKED+1,143
2130 IFE=1IFHV=8THEN2290ELSEIFB(HV+1,VV)THEN7010
2140 IFE=2IFVV=1THEN2290ELSEIFB(HV,VV-1)THEN7010
2150 IFE=3IFHV=1THEN2290ELSEIFB(HV-1,VV)THEN7010
2160 IFE=4IFVV=8THEN2290ELSEIFB(HV,VV+1)THEN7010
2170 IFE=1IFVV<>1IFB(HV+1,VV-1)THENE=4:GOTO2120
2180 IFE=1IFVV<>8IFB(HV+1,VV+1)THENE=2:GOTO2120
2190 IFE=2IFHV<>1IFB(HV-1,VV-1)THENE=1:GOTO2120
2200 IFE=2IFHV<>8IFB(HV+1,VV-1)THENE=3:GOTO2120
2210 IFE=3IFVV<>1IFB(HV-1,VV-1)THENE=4:GOTO2120
2220 IFE=3IFVV<>8IFB(HV-1,VV+1)THENE=2:GOTO2120
2230 IFE=4IFHV<>1IFB(HV-1,VV+1)THENE=1:GOTO2120
2240 IFE=4IFHV<>8IFB(HV+1,VV+1)THENE=3:GOTO2120
2250 IFE=1THENHV=HV+1:GOTO2120
2260 IFE=2THENVV=VV-1:GOTO2120
2270 IFE=3THENHV=HV-1:GOTO2120
2280 VV=VV+1:GOTO2120
2290 IFE=1THENX2=25-VV:GOTO2330
2300 IFE=2THENX2=33-HV:GOTO2330
2310 IFE=3THENX2=VV:GOTO2330
2320 X2=8+HV
2330 IFX2=X1THEN7000
2340 N1(X1)=N2(IM):N1(X2)=N2(IM):SC=SC+2:IM=IM+1:GOTO7020
3000 GOSUB8410
3010 PRINT@99,"PLACE A GUESS BALL";:PRINT@227,"0 RETURNS TO MENU
";:GOSUB6000
3020 G(HG,VG)=-1:D=VI+65+64*HG+3*VG
3030 POKED,133:POKED+1,138
3040 GOTO7020
4000 GOSUB8410
4010 PRINT@99,"REMOVE GUESS BALL";:PRINT@227,"0 RETURNS TO MENU"
;:GOSUB6000
4020 G(HG,VG)=0:D=VI+65+64*HG+3*VG
4030 POKED,143:POKED+1,143
4040 GOTO7020
5000 CLS:FORI=1TO8:FORJ=1TO8:D=VI+65+64*I+3*J:POKED,143:POKED+1,
143:NEXTJ,I
5010 FORI=1TO8:FORJ=1TO8:IFG(I,J)THEND=VI+65+64*I+3*J:POKED,133:
POKED+1,138:NEXTJ,I:ELSENEXTJ,I
5020 GOTO7020
6000 FORI=1TO8:PRINT@1+3*I,I;:PRINT@94+I*64," ";CHR$(64+I);:NEXT
6030 PRINT@803,"ENTER GUESS (EX: E6)? ";
6035 Y0=INKEY$:IFY0=""THEN6035ELSEIFY0="0"THENPRINTY0;:FORI=1TO2

```

Program continues



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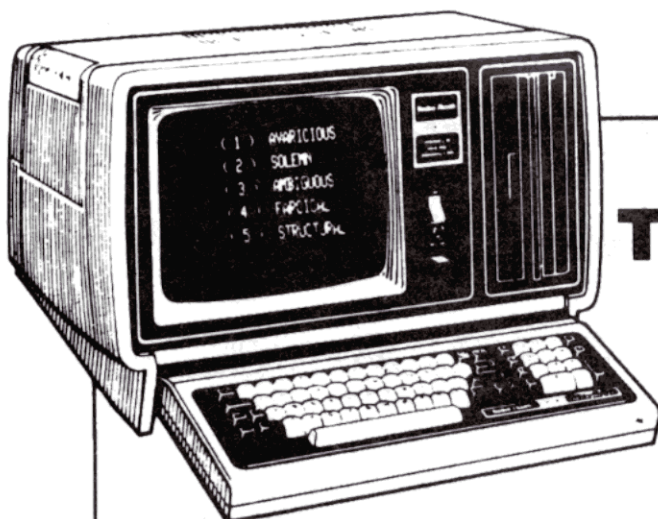
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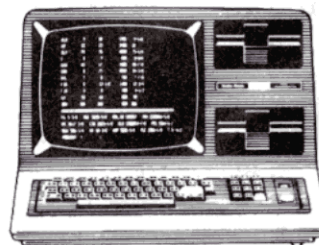
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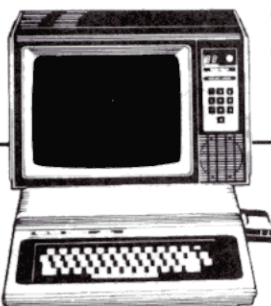
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From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical information on the TRS-80 color computer™. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

NOTE: This and other interesting and needed articles for the Radio Shack TRS-80 color computer™ are being included monthly in 68 Micro Journal—The Largest specialty computer magazine in the world!

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00: NEXT: GOTO 6075

6040 IFASC(Y0)<65ORASC(Y0)>72 THEN 6035 ELSE PRINT Y0;

6050 Y1=INKEY\$: IF Y1="" THEN 6050 ELSE IF Y1=CHR\$(08) THEN PRINT CHR\$(08)

;: GOTO 6035: ELSE IF VAL(Y1)<10 OR VAL(Y1)>8 THEN 6050 ELSE PRINT Y1;

6060 Y=INKEY\$: IF Y="" THEN 6060 ELSE IF Y=CHR\$(08) THEN PRINT CHR\$(08);: G

OTO 6050

6070 HG=ASC(Y0)-64: VG=VAL(Y1)

6075 FOR I=1 TO 8: PRINT @1+3*I, " ";: PRINT @94+I*64, " ";: NEXT: IF Y0=""

0 THEN 610

6080 RETURN

0 THEN 610

6080 RETURN

7000 N1(X1)="R ": SC=SC+1: GOTO 7020

7010 N1(X1)="H ": SC=SC+1

7020 FOR I=1 TO 8: PRINT @65+3*I, N1(I);: NEXT

7030 FOR I=9 TO 16: PRINT @156+64*(I-9), N1(I);: NEXT

7040 FOR I=17 TO 24: PRINT @665-3*(I-17), N1(I);: NEXT

7050 FOR I=25 TO 32: PRINT @577-64*(I-25), N1(I);: NEXT

7060 IF C THEN 8000

7070 GOTO 610

8000 IF X1=2 THEN 8340 ELSE IF X1=7 THEN 8310 ELSE IF X1=14 THEN 8280 ELSE IF X1

=15 THEN 8270 ELSE IF X1=13 THEN 8260 ELSE IF X1=30 THEN 8220 ELSE IF X1=28 THEN

8180 ELSE IF X1=31 THEN 8140 ELSE IF G(2,5) THEN 8120 ELSE CLS: PRINT @89, "BLA

CK BOX"

8010 PRINT @195, "THE OBJECT OF THE GAME IS TO LOCATE THREE, FOUR

OR FIVE"

8020 PRINT "RANDOMLY HIDDEN BALLS IN AN EIGHT BY EIGHT FIELD. YO

U WILL"

8030 PRINT "LOCATE THEM BY SENDING RAYS INTO THE FIELD FROM THE S

IDES."

8040 PRINT "A BALL WILL ABSORB A RAY THAT STRIKES IT DIRECTLY, OR

DEFLECT"

8050 PRINT "A RAY THAT COMES WITHIN ONE SQUARE."

8060 PRINT " FOLLOWING ARE SEVERAL EXAMPLES OF HOW RAYS WILL AC

T WHEN"

8070 PRINT "LAUNCHED INTO THE FIELD. a RAY WILL EITHER BE A HIT,

A"

8080 PRINT "REFLECTION, OR BE DEFLECTED TO LEAVE THE MATRIX AT AN

OTHER"

8090 PRINT "POINT. PRESS ENTER EACH TIME FOR THE NEXT EXAMPLE."

8100 GOSUB 8420

8110 CLS: B(2,5)=-1: B(4,5)=-1: B(6,8)=-1: G(2,5)=-1: G(4,5)=-1: G(6,8)

)=-1: GOTO 5000

8120 PRINT @99, "HERE IS A TYPICAL BALL";: PRINT @163, "ARRANGEMENT.

A VECTOR SENT";: PRINT @227, "IN FROM 31 WOULD BE A HIT.";

8130 GOSUB 8420: X1=31: GOTO 2030

8140 GOSUB 8420

8150 GOSUB 8410

8160 PRINT @99, "A RAY FROM 28 WOULD";: PRINT @163, "DEFLECT TO 21, A

ND";: PRINT @227, "THE COMPUTER WOULD GIVE";: PRINT @291, "BOTH NUMBER

S A DOUBLE";: PRINT @355, "LETTER MARKER.";

8170 GOSUB 8420: X1=28: GOTO 2030

8180 GOSUB 8420

8190 GOSUB 8410

8200 PRINT @99, "A RAY FROM 30 WOULD BE";: PRINT @163, "REFLECTED BAC

K TO 30,";: PRINT @227, "AND MARKED WITH AN R.";

8210 GOSUB 8420: X1=30: GOTO 2030

8220 GOSUB 8420

8230 GOSUB 8410

8240 PRINT @99, "RAYS SENT IN FROM 13 AND";: PRINT @163, "15 WOULD AL

SO BE";: PRINT @227, "REFLECTIONS, AND MARKED";: PRINT @291, "WITH AN

R.";

8250 GOSUB 8420: X1=13: GOTO 2030

8260 X1=15: GOTO 2030

8270 X1=14: GOTO 2030

8280 GOSUB 8420

8290 GOSUB 8410: PRINT @99, "A RAY FROM 7 WOULD";: PRINT @163, "BE DEFL

ECTED TWICE,";: PRINT @227, "AND MARKED WITH A";: PRINT @291, "DIFFERE

NT DOUBLE LETTER.";: PRINT @355, "WATCH THIS ONE.";

8300 GOSUB 8420: X1=7: GOTO 2030

8310 GOSUB 8420

8320 GOSUB 8410: PRINT @99, "RAYS ENTERED AT 1, 2,";: PRINT @163, "OR 3

WOULD FALL ALL THE";: PRINT @227, "WAY THROUGH. HERE IS";: PRINT @2

91, "2, FOR EXAMPLE.";

8330 GOSUB 8420: X1=2: GOTO 2030

8340 GOSUB 8420

8350 CLS: PRINT " YOUR SCORE IS THE NUMBER OF MARKERS TOTAL THAT

YOU USE"

8360 PRINT "TO LOCATE THE BALLS. THE OBJECT IS TO HAVE THE LOWES

T TOTAL"

8370 PRINT "SCORE.";: PRINT: PRINT " YOU MAY PLACE BALL GUESSES AND

REMOVE BALL GUESSES AT ANY"

8380 PRINT "TIME. WHEN YOU THINK YOU HAVE A CORRECT LAYOUT, STOP

AND"

8390 PRINT "SCORE. AN INCORRECT BALL LOCATION COSTS FIVE POINTS.

"

8400 GOSUB 8420: CLS: GOTO 50

8410 FOR I=1 TO 12: PRINT @35+I*64, STRING\$(29, " ");: NEXT: RETURN

8420 PRINT @803, "PRESS ENTER";: INPUT Y: RETURN

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Has things that other programs should have, but don't. Upper and lower case output to your printer (if your printer accepts lower case) without having your computer modified. ON UPPER CASE ONLY MACHINES: This program marks the capital letters so you can see which letters are CAPITALS and which are not. / Will change all upper characters text to lower case or all lower case to upper. A SINGLE COMMAND / Will capitalize the first letter of all sentences and all proper noun's. WITH A SINGLE COMMAND / LOADS ANY ELECTRIC PENCIL / FILE, ASCII SAVED FILES, EDTASM FILES or BASIC PROGRAMS SAVED ASCII / Permits installing special control characters in your text for your printers special features, like double wide or condensed print / Definable screen length and definable print length to 255 characters wide / Screen editing that is not final till your command. This means that you can edit your file on the screen and if you don't like how it reads you can cancel and leave it the way it was / You can append files (which means that you can put one file to the end of another file) / No lost characters at the end of the line, even for the fastest typist / A directory of all your files is available to the user without leaving the program / Saving programs to disk easy enough for the non-computer user / To save memory, not all the program modules are in memory at one time but are called from the disk as needed / You can set tab positions like on a typewriter / 10 CUSTOM COMMAND KEYS for the experienced user there is a command file that permits many special functions that are all user defined (not enough space for better explanation in ad, send for complete overview) / Program has HELP file that is a short review of the commands that are available /

Standard Printer Module. This printer module is provided for the user as a standard feature. Optional special printer routines for custom printer will be available in the near future. In this original release, it has the following printer drivers and will support the following printing devices: RS232, TRS232 and PARALLEL printer ports. You have the following format commands: Justifies Text, Centers Text, Centers Title, Line Spacing, Line Length from 3-255

characters and Set Margins / Also send any ASCII code to any printer from the text / Save formatted text to the disk for spooling later / Information for customer to load his own special printer driver / Printing can be stopped and started by the user at any time and then restarted where you left off / You can print entire file or just print to bottom of the page /

Communication Package. RS232 COMMUNICATION TERMINAL PROGRAM permits you to communicate with other computers. Transfer files from one machine to another. Permits dumping memory across the phone lines. Receive files from other TRS-80's and "Shake Hands" with larger computers. This is the complete system called LAZY WRITER. There is no package written for the TRS-80* that is as comprehensive. This package is available for the TRS-80* MOD I, 32K or larger with at least a single disk drive. List price is from

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NEW FEATURES in Lazy Writer

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The system permits embedding ASCII commands into the text of the program. NOW you can do SUPERScript and SUBScript (if your printer can handle it). Underlining and boldface, printing of a single word in a paragraph, is now possible, at no extra cost.

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User definable special character. For use with printers that have printable characters that the TRS-80 keyboard does not normally support.

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Page offset with odd/even headers & footers. This means that you can print one page offset to the left of center and the next page offset to the right. This is very nice when you are writing a book.

Printing chaining feature. This permits having more than one file on disk and create one printed letter, contract, or book without having to reset the printer commands.

Mandatory space command. This is necessary when you are writing letters or papers that have certain words that are not to be broken-up. eg. John P. Andhouser. This name can be made to be unbreakable to justify routines in the program.

Disk catalog. Now you can load your disk directory into memory and create a file of this information.

Now loads Machine Language extension programs that are written for Lazy Writer.

An alternative to expensive Model II letter crunchers.

Everyman's Mod II Word Processor

Mike Kilroy, AC8V
6213 Concerto Ct.
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Many good word processors are available for the Model I from various magazines, but to put your Model II to work as a word processor requires a substantial outlay of cash. Instead of laying out many dollars for a Model II processor, I've modified an existing Model I program. The original program appeared in *80 Microcomputing's* May, 1980 issue, written by Delmer D. Hinrichs.

The program performs the following:

- Creates or adds to text
- Right justifies
- Compiles
- Sets formats for letters and the printer
- Deletes blank lines automatically
- Deletes specified line(s)
- Edits on a per line basis
- Displays all legal functions
- Inserts line(s) at any point in the program
- Deletes whole texts from memory or disk
- Saves/loads any text to/from disk complete with its corresponding format
- Moves whole blocks of text
- Replaces one whole line with a new one
- Provides a table of contents of all letters or text
- Titles and pages, if wanted

What more could you want? The speed of this program in a standard 64K Model II is over 90 wpm. Could you keep up? The program has 17 commands, two of which have extensive subcommands.

Featured Commands

The Add command lets you add lines to text. An addition may be two lines or 100

lines long. Available in the add mode are the following subcommands:

- | | |
|-----------|---------------------------------------|
| Enter key | Ends line and carriage return. |
| Control J | Erases present line to start it over. |

- | | |
|-------------|---|
| Down arrow | Ends line and page, adds end page marker (←). |
| Right arrow | Moves line all the way to the right. |
| Up arrow | Centers, ends, adds, "do not justify marker" (/) to present line. |

Program Listing

```
10 CLS:PRINTTAB(20)"BASIC WORD PROCESSOR"
30 DEFINT A-Z:CLEAR21000:NL=360:DIMA$(NL),X$(3),S(25),T(25)
40 B$=CHR$(23):C$=CHR$(143):F$="###":N$="Y":PN$="N":P1$="Y"
50 S$="":H$=S$:LA=-1:P=1:FP=1:PL=23:LL=60:LM=10:U=32:G=10:H=6:V=27
60 ONERRORGOTO1645:L=LA:IT=0:R=0:A$="":PRINT:INPUT"COMMAND":A$:IFA$=""GOTO80
70 A=ASC(A$)-64:IFA$0THENONAGOTO90,480,510,760,790,1220,80,1320,1350,1390,1510,1
522,1580,80,80,1640,80,1750,1770,1520,80,1830,80,19
70
80 PRINT"*** ENTRY ERROR ***":GOTO60
90 CLS:D=0:N$="Y":IFLA(0)THENL=0:GOTO130 'add
100 IF NL=LA+1THEN210ELSEIFL>FL+12THENB=L-12ELSEB=FL
110 FORI=BTOL:X=LEN(A$(I)):D=D+INT((X+4)/80-.01)
120 GOSUB1910:NEXTI:L=L+1
130 C=(L-FL+D)*80:IFC>1760THENPRINT:PRINT:C=1760
140 PRINTAC,USINGF$1L:PRINTA$(L):P=LEN(A$(L))+1:C=C+P+3:K=L+1
150 PRINTAC,C$CHR$(02):A$=INKEY$:PRINTAC,S$:IFA$=""THEN150
160 GOSUB290:ONA=7GOTO360,410
170 IFA=13THENA$=S$:GOTO210ELSEIFA=10THEN380ELSEIFA=31THEN460
180 IFA=29THENA$30ELSEIFA=30THEN330ELSEIFA=28THEN310
190 IFA=27THENIFLA(L)THENLA=L:GOTO60ELSE60
200 PRINTAC,A$:A$(L)=A$:A$:IFP=LLTHENP=P+1:C=C+1:GOTO150
210 IFRTHE60ELSEIFNL(=K)THENPRINT:PRINT"FILE FULL":LA=NL-1:GOTO60
220 IFLEN(A$(K))THENL=K:GOSUB1360
230 IFK=LATHENLA=K
240 IFA$=S$THEN280
250 FORM=LL+1TOSTEP-1:A$=MID$(A$(L),M,1):IFA$(S$)THENNEXTM:GOTO280
260 A$(K)=RIGHT$(A$(L),LL-M+1):A$(L)=LEFT$(A$(L),M-1)
270 PRINTAC-LL+M-1,B$:L=K:GOTO130
280 A$(L)=LEFT$(A$(L),LL):L=K:GOTO130
290 A=ASC(A$):RETURN
310 IFP>LLTHEN210 'd
320 PRINTAC,CHR$(92):A$(L)=A$(L)+CHR$(17):A$=S$:GOTO210
330 IFP>LLTHEN210 's-d
340 C=(L-FL+D)*80+4:IFC>1764THENC=1764
350 GOSUB1180:P=1:A$=S$:GOTO210
360 IFP=1THEN150 'i
370 C=C-1:PRINTAC,B$:P=P-1:A$(L)=LEFT$(A$(L),P-1):GOTO150
380 IFP=1THEN150 's-i
390 A$(L)=""P=1:C=(L-FL+D)*80+4:IFC>1764THENC=1764
400 PRINTAC,B$:GOTO150
410 IFP>LLTHEN150 'r
420 A$(L)=A$(L)+STRING$(5,S$):C=C+5:P=P+5:GOTO150
430 IFP>LLTHEN210 's-r
440 C=(L-FL+D)*80+4:IFC>1764THENC=1764
450 GOSUB1200:P=1:A$=S$:GOTO210
460 IFP>LLTHEN210 'c
470 PRINTAC,CHR$(93):A$(L)=A$(L)+CHR$(20):A$=S$:GOTO210
```

Program continues

```

480 CLS:PRINT"DELETING BLANK LINES":FORJ=LATO0STEP-1:blank
490 IFA$(J)=0:THENFORI=JTO0:A$(I)=A$(I+1):NEXTI:A$(LA)=0:LA=LA-1
500 NEXTJ:IFRTHENRETURNELSE1830
510 INPUT"FIRST LINE TO COMPILE":F:IFF(0THENF=0:compile
520 INPUT"LAST LINE TO COMPILE":Z:IFZ:LATHENZ=LA
530 IFF=Z:THEN0ELSECLS:PRINT"COMPILE":FORL=FTOZ-1:K=L+1
540 X=LEN(A$(L)):X$="":IFX(2THEN60ELSEIFX(=LLGOTO0600
550 FORI=XTOSTEP-1:A$=MID$(A$(L),I,1)
560 IFA$(I)S$THENX$=A$+X$:NEXTI:GOTO60ELSEIFX$="":THENNEXTI
570 A=ASC(RIGHT$(X$,1)):IFA=33ORA=46ORA=58ORA=63THENX$=X$+" "
580 A$(L)=LEFT$(A$(L),I-1):IFLEN(A$(K))=0THENA$(K)=X$:GOTO540
590 A$(K)=X$+S$+A$(K):GOTO540
600 X=LEN(A$(L)):IFX(2THEN60ELSEFORI=XTOSTEP-1
610 IFRIGHT$(A$(L),1)=S$THENA$(L)=LEFT$(A$(L),I-1):NEXTI
620 NEXTL:FORL=FTOZ-1:K=L+1
630 X=LEN(A$(L)):Y=LEN(A$(K)):X$="":IFX=0ORY=0THEN750
640 A=ASC(RIGHT$(A$(L),1))
650 IFA=33ORA=46ORA=58ORA=63THENA$(L)=A$(L)+" ":X=X+1
660 FORI=1TOY:A$=MID$(A$(K),I,1)
670 IFA$(I)S$THENX$=X$+A$:NEXTIELSEIFX$="":THENNEXTI
680 IFLL=X(ITHEN710
690 Y=Y-I:IFY(0THENY=0
700 A$(L)=A$(L)+S$+X$:A$(K)=RIGHT$(A$(K),Y):GOTO630
710 X=LEN(A$(L)):IFX(2THEN730ELSEFORI=XTOSTEP-1
720 IFRIGHT$(A$(L),1)=S$THENA$(L)=LEFT$(A$(L),I-1):NEXTI
730 IFY(2THEN750ELSEFORI=YTOSTEP-1
740 IFLEFT$(A$(K),1)=S$THENA$(K)=RIGHT$(A$(K),I-1):NEXTI
750 NEXTL:X=LEN(A$(Z)):GOTO900
760 INPUT"FIRST LINE TO DELETE":F:IFF(0THENF=0:delete
770 INPUT"LAST LINE TO DELETE":Z:IFZ:LATHENZ=LA
780 IFF=Z:THEN0ELSEFORI=FTOZ:A$(I)=0:NEXTI:GOTO1830
790 INPUT"EDIT LINE":L:IFL(0ORL)LAORA$(L)=0:THEN80:edit
800 C=4:P=1:X$(0)=A$(L):N$="Y"
810 CLS:I=L:GOSUB1910:N=N+1:Q$=" "
820 GOSUB910:IFA 4AND A(58)THENQ$=Q$+A$:N=VAL(Q$):GOTO820
830 M=0:IFA=8THENY=1:GOSUB940ELSEIFA=9THENY=5:GOSUB940ELSEIFA=UTHENY=1:GOSUB940
840 IFA=65THENA$(L)=X$(0):GOTO800: a
850 IFLEN(A$(L))=LLTHEN870
860 IFA=29THENGOSUB1200ELSEIFA=30THENGOSUB1180
870 IFA=66THENGONON-66GOSUB960,1000,1960,1960,1960,1020,1030
880 IFA=83THENGOSUB1120ELSEIFA=88THENGOSUB1170ELSEIFA=76THENGOSUB800
890 IFM=1THENN=1:Q$="":GOTO820ELSEIFRTHENPRINT400,1:ELSE810
900 IFLL(XTHENPRINT"LINE":L:"HAS":X:"CHARACTERS":GOTO60ELSE1830
910 X$=MID$(A$(L),P,1)
920 PRINT@C,C$:CHR$(02):A$=INKEY$:PRINT@C,X$:IFA$="":THEN920
930 GOSUB290:C$=LEN(A$(L)):IFA=13THENR=1:RETURNELSERETURN
940 M=1:FORI=1TON:P=P+Y:IFP)XTHENP=X:RETURN
950 IFP(1THENP=1:RETURNELSEC=C+Y:NEXTI:RETURN
960 Q=P:D=C:FORI=1TON:GOSUB910:IFRORA=27THENP=Q:C=D:RETURN: c
970 PRINT@C,A$:GOSUB1100:P=P+1:GOSUB1110:A$(L)=L$+A$+R$
980 A=U:C=C+1:IFP(=XTHENNEXTI
990 P=Q:C=D:RETURN
1000 IFF+N-1)XTHENN=X-P+1: d
1010 GOSUB1100:D=P:P=P+N:GOSUB1110:A$(L)=L$+R$:P=Q:RETURN
1020 GOSUB1100:A$(L)=L$+S$:PRINT@C,B$: h
1030 GOSUB910:IFRORA=27THENRETURN: i
1040 IFA=28THENA$(L)=A$(L)+CHR$(17):R=1:RETURN
1050 IFA=31THENA$(L)=A$(L)+CHR$(20):R=1:RETURN
1060 PRINT@C,A$:IFA=8THENY=-1:GOSUB940:GOTO1030
1070 IFA=9THENY=1:GOSUB940:GOTO1030ELSEIFP)XTHENX=P
1080 GOSUB1100:GOSUB1110:A$(L)=L$+A$+R$:PRINT@C,B$:A$+R$
1090 C=C+1:P=P+1:GOTO1030
1100 L$="":IFP(2THENRETURNELSEL$=LEFT$(A$(L),P-1):RETURN
1110 R$="":IFP)XTHENRETURNELSER$=RIGHT$(A$(L),X-P+1):RETURN
1120 GOSUB910:Q=P:D=C: s
1130 FORI=1TON:F=0:FORJ=0+1TOX:D=D+1
1140 IFMID$(A$(L),J,1)=A$THENF=1:Q=J:J=X
1150 NEXTJ:NEXTI:IFFTHENP=Q:C=D
1160 A=U:RETURN
1170 A$(L)=A$(L)+S$:P=X+1:C=P+3:GOTO1030: x
1180 A$(L)=STRING$(LL-LEN(A$(L)),2,32)+A$(L)+CHR$(17): s-d
1190 PRINT@C,B$:LEFT$(A$(L),LEN(A$(L))-1):CHR$(92):RETURN
1200 A$(L)=STRING$(LL-LEN(A$(L))+1,32)+A$(L)+CHR$(13): s-r
1210 PRINT@C,B$:A$(L):RETURN
1220 CLS:PRINT"LINE LENGTH =":LL:INPUT"NEW =":LL:format
1230 PRINT"LINE SPACES =":S:INPUT"NEW =":S
1240 PRINT"LINE NOS. =":N$:INPUT"NEW (Y/N)":N$
1250 PRINT"FIRST LINE =":FL:INPUT"NEW =":FL
1260 PRINT"LEFT MARGIN =":LM:INPUT"NEW =":LM
1270 PRINT"PAGE LENGTH =":PL:INPUT"NEW =":PL
1280 PRINT"PAGE NOS. =":PN$:INPUT"NEW (Y/N)":PN$
1290 PRINT"FIRST PAGE =":FP:INPUT"NEW =":FP
1300 PRINT"PAGE 1 NO. =":P1$:INPUT"NEW (Y/N)":P1$
1305 PRINT"CHAR/INCH =":G:INPUT"NEW (5,10,16,5) =":G
1307 PRINT"LINE/INCH =":H:INPUT"NEW (6,8) =":H
1310 PRINT"HEADING =":H$:INPUT"NEW =":H$:GOTO60
1320 CLS:PRINT"LEGAL COMMANDS ARE:PRINT:PRINT:help
1330 PRINT"A ADD","B BLANK","C COMPILE","D DELETE","E EDIT","F FORMAT","H
HELP","I INSERT","J JUSTIFY","K KILL","L LOAD"
,"M MOVE","P PRINT","R REPLACE","S SAVE","V VIDEO","X EXIT","T TABLE OF C
ONTENTS"
1340 PRINT:PRINT:PRINT"PRESS (ESC) KEY TO RETURN FROM A,E,I,R COMMAND MODE":GOTO
60
1350 INPUT"INSERT AT LINE":L:IFL(0ORL)LATHENZ0:insert
1360 IF NL=LA+1THENPRINT"FILE FULL":GOTO60ELSEIFRTHEN60
1370 FORI=LATOLSTEP-1:A$(I+1)=A$(I):NEXTI
1380 A$(L)=0:LA=LA+1:L=L-1:IFITTHENRETURNELSEI=1:GOTO90
1390 CLS:PRINT"JUSTIFYING":FORL=0TOA:X=LEN(A$(L)):justify
1400 IFX(2THEN1500ELSEFORI=XTOSTEP-1:A=ASC(RIGHT$(A$(L),1))
1410 IFA=UTHENA$(L)=LEFT$(A$(L),I-1):X=X-1:NEXTI
1420 IFX)=LORA=17ORA=20THEN1500ELSEJ=0:K=1:FORI=1TOX
1430 IFMID$(A$(L),I,1)S$THENK=0ELSEIFK=0THENK=1:S(J)=I:J=J+1
1440 NEXTI:IFJ=0THEN1500
1450 K=RD(J)-1:IFINT(J/2)=J/2ORJ=1THENN=1ELSEN=2

```

Program continues

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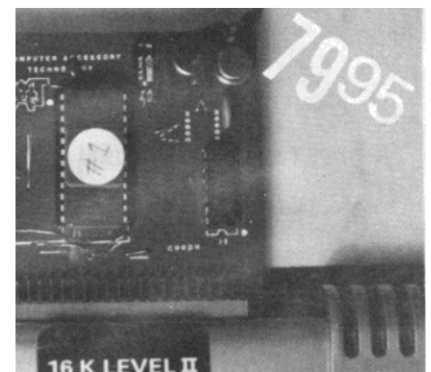
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Escape key	Ends adding session.	(L)	List the line and keep modifications.
Left arrow	Ends, adds "do not justify" marker to present line.	(A)	Cancel previous changes and start over.
Tab key	Moves cursor five spaces to right.	n(S)c	Search for the nth occurrence of character c.
Backspace	Backspaces and erases last entry.	Escape key	Quit H, I, X modes.
		Right arrow	Moves line all the way right, ends edit.

Though you can press Enter to end a line, the computer will automatically end it when you type the specified maximum number of characters per line. The computer shifts the whole word, if it extends beyond the maximum number of characters, to the following line.

The Blank command deletes all "no character" lines from the text. A space is a character. If you want a blank line in the text, say between your paragraphs, simply put one space on that line. This places a character (ASCII 32) on that line, and the Blank command will not touch it. As you will find out, this is a very useful command.

The Compile command will ask you the first and last line number that you wish to compile. It then shifts words from line to line, fitting the maximum number of words onto each line. Spaces at the beginning and end of all lines but the first are deleted. (It does not touch paragraph indentation on the first line.) For this reason Compile is best used on only one paragraph at a time. One space is inserted after each word, comma, and semicolon. Two spaces follow colons, periods, question marks and exclamation marks. Compiling only affects spaces after words and punctuation shifted between lines. For this reason, it should be used before the justifying command, or spaces added by justifying will be unaffected.

Use the Delete command to remove lines from the text. Delete leaves a blank line in place of the removed one. You can delete any number of consecutive lines at one time.

Now we get to the heart of the word processor: the Edit command. The edit mode works on one line at a time. Changes can be made with the following subcommands:

Tab key	Moves cursor five spaces to the right.
n(Backspace)	Left move of n spaces.
n(C)	Change next n characters to next n characters entered.
n(D)	Delete next n characters.
(X)	Extend the line.
(H)	Erase from present position in line to the end and enter extend mode.
(I)	Insert at the present position.

Up arrow	Centers line and adds "do not justify"; ends editing.
Left arrow	Adds "do not justify"; ends editing.
Enter key	Saves all changes and ends editing.

The "n" above indicates the number of characters wanted. N is set at one if not entered. The left arrow key puts a "do not justify" character at the end of the line, and, as such, you must enter the extend mode first to add it to the line. Any editing changes before listing the line will be made permanent. Therefore, if you hit L, then decide you really didn't want to make a certain change, hitting A will not erase it. Most of the single character commands listed above are basically the same as the TRS-80 Model II editing commands.

The Format command allows you to set up the various format parameters of the letter and printer. They are self-explanatory:

Number characters/lines
 Number spaces between lines
 Line numbers (Y/N)
 First line number
 Left margin indentation amount
 Number lines/page
 Page numbers (Y/N)
 First page number
 Numbers on page one (Y/N)
 Heading name
 Printer characters/inch
 Printer lines/inch

There is a Help command to assist you when you are inebriated or just plain too tired to recall the program's legal commands. It simply lists all the commands.

Insert is used to add those forgotten lines. After specifying the first line, the program goes into the add mode. All legal add mode subcommands are valid. Hitting the escape key will end the insert mode.

The Justify command right justifies the text. Any lines which don't have a "do not justify" or "end of page" marker will be right justified. Indentations at the beginning of lines are not touched. This command should be used after all compiling and editing is done.

Kill deletes the entire text on which you are working. It can also delete text that was previously stored on disk. A double check is

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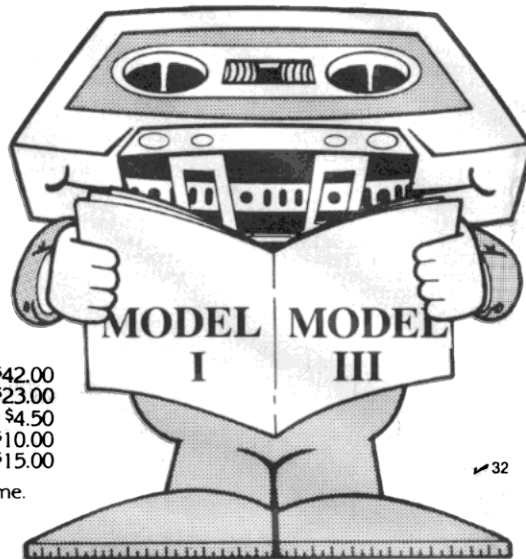
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"A double check is provided to prevent killing something mistakenly."

```

1460 FORI=1TOLL-X:T(K)=T(K)+1:K=K+N:IFK J-1THENK=K-J
1470 NEXTI:FORI=J-1TOSTEP-1:A%=STRING$(T(I),S%):T(I)=0
1480 A$(L)=LEFT$(A$(L),S(I))+A%+RIGHT$(A$(L),LEN(A$(L))-S(I))
1490 NEXTI
1500 NEXTL:GOTO1830
1510 CLS:INPUT"REALLY KILL (Y/N)";A$:IF A%="" THEN50 'kill
1512 INPUT"KILL PRESENT LETTER (Y/N)";A$:IF A%="" THENRUN
1514 INPUT"KILL ANY LETTER ON DISC (Y/N)";A$:IF A%="" THEN50
1516 INPUT"NAME OF LETTER ON DISC TO KILL";A$:KILL A$:GOTO60
1520 Z%="TABLE":GOTO1524
1522 INPUT"WHAT LETTER DO YOU WANT";Z%
1524 CLS:PRINT"LOADING FROM DISC: ";Z%
1525 OPEN"1",1,Z%
1530 INPUT#1,LA,LL,S,N%,FL,LM,PL,PN%,FP,P1%,H%
1540 FORI=0TOLASTEP4:INPUT#1,X$(0),X$(1),X$(2),X$(3)
1550 FORJ=0TOD3:L=I+J:X=LEN(X$(J)):A$(L)="" :IFX(1)THEN1570
1560 FORK=1TOX:A$(L)=A$(L)+CHR$(ASC(MID$(X$(J),K,1))-128):NEXTK
1570 NEXTJ:NEXTI:CLOSE:GOTO60
1580 INPUT"FIRST LINE TO MOVE";F:IF F(0)THENF=0 'move
1590 INPUT"LAST LINE TO MOVE";Z:IF Z(L)THENZ=LA
1600 IF F Z THEN80ELSEINPUT"FIRST NEW LINE";N:FORI=FTOZ
1610 IFLEN(A$(N))THENPRINT"LINE";N:"NOT EMPTY":GOTO60
1620 A$(N)=A$(I):A$(I)="" :N=N+1:IFN LATHENLA=N
1630 NEXTI:GOTO1830
1640 X=FP:M=FL:GOTO1661 'print
1645 IF ERR=5THENPRINT"YOU CAN'T DO THAT!!!!":FORQ=0TOD4000:NEXTQ:RESUME60
1647 IFERR=53THENPRINT"THAT FILE DOES NOT EXIST!!!!":RESUME60
1650 IFERR()56THENERRORGOTO00ELSEINPUT"PRINTER NOT READY. ABORT (Y/N)";A%
1660 IF A%="" THENRESUME60ELSEINPUT"FIX PROBLEM AND PRESS ENTER";A$:RESUME1640
1661 IFQ=5THENW=3:ELSEIFQ=10THENW=30ELSEIFQ=16,5THENW=29
1662 IFH=6THENW=54ELSEIFH=8THENW=56
1665 INPUT"WANT TO ADJUST TO TOP OF PAGE (Y/N)";A$:IF A%="" THENSYSTEM"FORMS T"
1670 INPUT"WANT TO CHECK FORM, #S, ETC. (Y/N)";Z$:IF Z%="" THEN1220ELSER=1:GOSUB
480:CLS:PRINT"PRINTING"

```

Program continues

provided to prevent killing something mistakenly. If you ask for a letter or text that is not stored on the disk, you will not get a "file not found" error; instead, you will be told "that letter does not exist" and the program will continue.

Like the Kill command, the Load command is protected against loading a non-existent text. It simply loads a specified text from the disk into the word processor.

Move is a very useful command which allows you to move as many lines as required from one position to another within the body of a letter. All necessary prompting is given to allow this command to be used.

The Print command actually puts your work on paper. It asks first if you would like to adjust to the top of the page. It then asks if you would like to double-check the forms to be sure the line numbers are off. If you are printing more than one page, the program stops and asks you to press Enter when ready to print the next page (X). This allows you time to put in new paper before going on.

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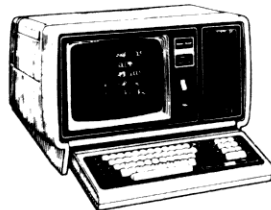
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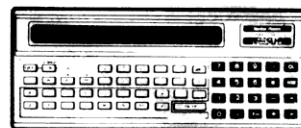
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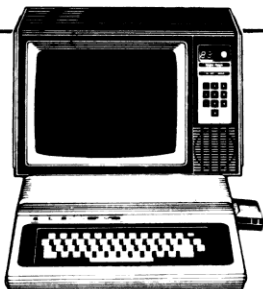
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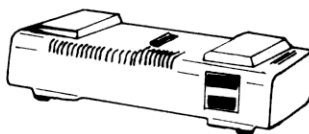
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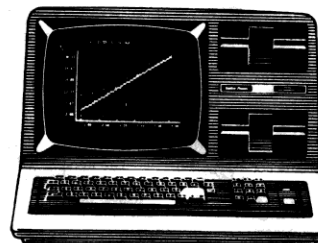
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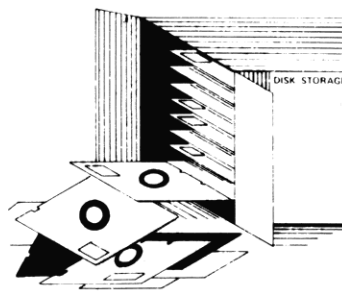
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"The Blank command deletes... lines from the text... As you will find out, this is... very useful."

whole line at a time. You specify what line you'd like to replace and then replace it.

You store a letter on disk with the Save command. Before you store it, you're prompted to save an updated version of the disk's table of contents.

Video displays the present text just as it will appear when printed. Many times, for instance after changing a parameter, you'll want to see the entire text.

Exit allows you to escape from the word processor program gracefully. The exact method used will be up to you. You may want to simply say end or stop on line 1980.

Table of contents was added as an afterthought and has proven very helpful. I added the table of contents to list all letters saved. That way you don't need to hit Break, System directory to find a letter. Entering T will get you the table of contents from the disk, which is just a letter named table stored on the disk.

I've set up this system with a Microline printer and Radio Shack Line Printer III. Undoubtedly other modifications to the print program may be necessary to accommodate other printers. ■

```
1680 LPRINTCHR$(W),CHR$(V);CHR$(T);:IFPN$( )="Y"OR(P1$="N"ANDX=1)THEN1700
1690 LPRINTTAB(LM)H$;TAB(LL+LM-7)"Page";USING"###";X:LPRINT
1700 FORP=MTOM+PL-1:IFP)LATHEN1740
1710 M=M+1:IFSTHENLPRINTSTRING$(S,10)
1720 LPRINTTAB(LM);:IFN$="Y"THENLPRINTUSINGF$;P;
1730 LPRINTA$(P);IFASC(RIGHT$(A$(P),1))<20THENEXTP
1740 IFP)LATHEN60ELSESYSTEM"FORMS T";PRINT"PAGE";X+1;"READY, IF SO PRESS ENTER";
:INPUT:X=X+1:GOTO1680
1750 INPUT"REPLACE LINE";L:IFL<0ORL)LATHEN80'replace
1760 R=1:A$(L)="" :L=L-1:GOTO90
1770 TC$="" :INPUT"SAVE UPDATED TABLE OF CONTENTS (Y/N)";TC$:IFTC$="Y"THENZ$="TAB
LE":GOTO1773'save
1772 INPUT"PLEASE NAME THIS LETTER";Z$
1773 CLS:PRINT"SAVING PRESENT LETTER ON DISK AS: ";Z$
1775 OPEN"O",1,Z$
1780 PRINT#1,LA,"LL","S","N$","FL","LM","PL","PN$","FP","P1$","H$;FORL=0TOLASTE
P4
1790 FORJ=0TO3:I=L+J:X=LEN(A$(I));X$(J)="" :IFX<1THEN1810
1800 FORK=1TOX:X$(J)=X$(J)+CHR$(ASC(MID$(A$(I),K,1))+128):NEXTK
1810 NEXTJ:PRINT#1,X$(0),"X$(1)","X$(2)","X$(3):NEXTL:CLOSE:GOTO60
1830 CLS:X=FP-1:FORM=FLTOLASTEPL:X=X+1'video
1840 IFP1$="N"ANDX=1THEN1860
1850 IFPN$="Y"THENPRINTH$;TAB(LL-7)"Page";USING"###";X:PRINT
1860 FORI=MTOM+PL-1:IFI)LATHEN1890
1870 IFSTHENPRINTSTRING$(S-1,10)
1880 GOSUB1910
1890 NEXTI:A$="" :IFI<=LATHENINPUT"PRESS ENTER";A$:IFA$( )=""THENM=LA
1900 NEXTM:L=LA:GOTO60
1910 Y=LEN(A$(I)):IFYTHENA=ASC(RIGHT$(A$(I),1))ELSEA=0
1920 IFN$="Y"THENPRINTUSINGF$;I;
1930 PRINTA$(I);:IFA=17THENPRINTCHR$(92);
1940 IFA=20THENPRINTCHR$(93);ELSEIFA=0THENPRINTCHR$(95);
1950 IFN$( )="Y"ORY<80THENPRINT
1960 RETURN
1970 CLS:INPUT"REALLY EXIT (Y/N)";A$:IFA$( )="Y"THEN60'exit
1980 CLS:CLERA500:PRINT"THE END":LOAD"INLAND",R
```

EDAS

EDAS is a sophisticated Editor and Assembler for the '80 Model I or Model III. All commands and SOURCE text can be entered in upper or lower case. Direct assembly for memory or multiple disk files by means of *GET assembler directives provides the capability of assembling huge source files with 30,000 bytes of symbol table. Direct assembly to disk or memory for faster debugging operations. DOS functions DIR, KILL, and LIST are available from within EDAS. The Editor provides block move & global change with BASIC syntax editing. EDAS provides power with ease of use. \$79 + \$S&H.

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LDOS 5.0

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GRBASIC

GRBASIC extends Level II or DISK BASIC to include an easy to use graphics command set. A single BASIC command allows the user to draw a line between any two pixels on the screen in hundredths of a second! Coordinates can be chained to allow complex figures to be drawn by a single BASIC program line in less than a second!

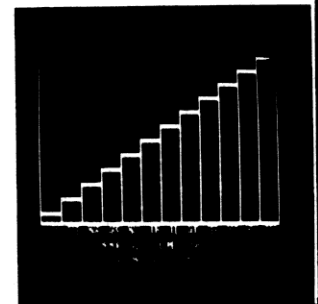
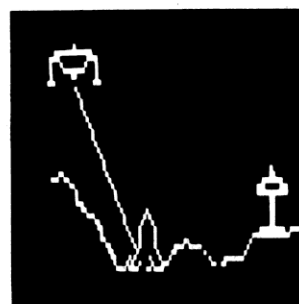
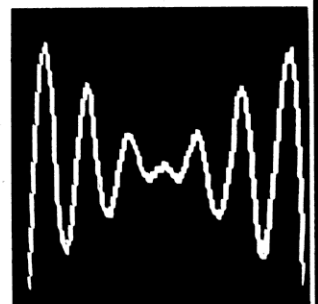
GRBASIC allows the definition of shapes. Once defined, a shape can be **rotated**, **scaled** up or down in size, drawn anywhere on the screen in less than a second, and can even be drawn totally or partially "off" the screen in extended space! And all with short, simple BASIC commands! Even multiple shapes are no problem!

GRBASIC is not a string-packer or machine-language USR-called utility. GRBASIC is fully integrated into Level II and DISK BASIC. There is nothing on the market that offers its graphic features, except possibly the Apple II computer! Animation, scientific plotting, and professional data displays are now child's play!

A new program, GRBASIC FUNCTION PLOTTER, allows the plotting of almost any function, including polar coordinate based figures and almost any wave form. Features include function definition and automatic screen scaling. **REQUIRES GRBASIC!**

GRBASIC cassette	\$19.95
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GRBASIC FUNCTION PLOTTER	\$14.95

Examples of graphics produced with GRBASIC



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Micro-World is an adventure like no other. You are transformed into an electroid, and must travel through the circuits of your TRS-80! You will be required to solve many incredible problems, and in the process you will gain a knowledge of how a TRS-80 operates.

Micro-World is one of the most advanced pieces of machine language programming Med Systems has published. A special encoding scheme has allowed a 21K adventure to fit in 16K. Micro-World is verbose. Messages are frequent and fact filled. There are over 80 locations that must be explored.

Micro-World is an excellent educational simulation! It is supplied with a booklet containing a glossary and explanations of the electronic circuits inside the TRS-80. This does not in any way diminish the challenge! If anything, the challenge increases since you must gain a working knowledge of your computer to gain access to the final circuit!

Model I Level II 16K or Model III 16K cassette \$19.95
Model I disk \$24.95

The Playful Professor

The Playful Professor has been a constant best-seller since its introduction in 1980. This program is a mathematical tutorial that provides instruction in addition, subtraction, multiplication, and division, with or without fractions. Problems are presented in a game format that gives a step-by-step tutorial for incorrect answers.

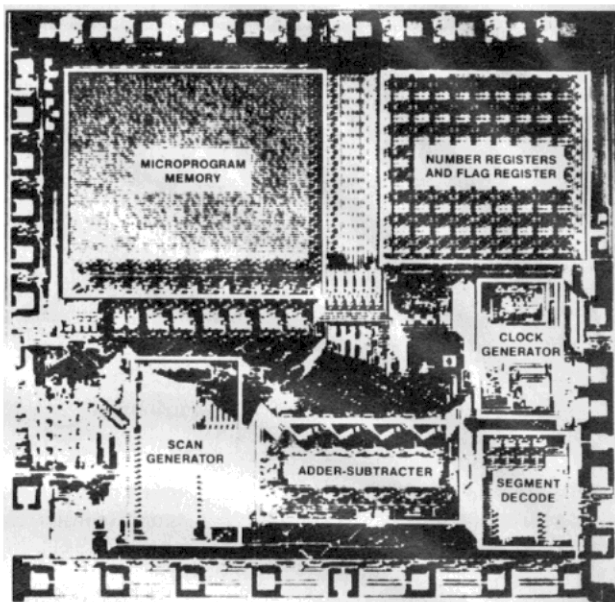
The Playful Professor places the user in a 60 room mansion haunted by an intelligent ghost who holds the key to the only door out. Options include 3 difficulty levels, choice of problem type, 1 or 2 players, pass option, and split difficulty levels to allow 7 year olds to play competitively with 27 year olds! Graphics are used extensively.

"I'm so impressed with The Playful Professor, Money Master, and Deathmaze. At the Mead School we use these three programs daily." R.J., Greenwich, Conn.

"My 7 year old daughter had a fun way to review her math... my 4 year old enjoys playing using the pass feature (what an experience it is to watch a 4 year old use a computer!)" S.C., Highland, Maryland

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Model I DISK \$16.95

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Archbold's Mod I Speed-Up Kit

Model 1 Speed-Up
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Richard C. McGarvey
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Every computerist wants to do his computer work as fast as possible. Efficient programs are a good way to speed up your work. Compressing code or using faster code such as machine language also helps speed up your computer's operation. There are other tricks, but there is always the ultimate limitation of the clock speed of your computer. No matter how efficient your code or how fast your accessories, you can't beat the built-in limitation of a slow clock speed.

In the case of the TRS-80 Model I, that clock speed is based on the Z-80 CPU. The Z-80 is rated at two MHz but can function safely at about three MHz. Tandy, however, decided that for the best cassette I/O speed (and whatever other reasons) to limit the speed of the Model I to approximately 1.77 MHz. (I say approximately because slight differences between machines exist.) This is built-in slow down and not an insurmountable problem, since the computer is not operating at its maximum efficiency.

No Electronic Genius

I recently purchased a speed-up kit and installed it. I'm no electronic genius. In fact, I have trouble soldering, let alone accomplishing anything major. For that reason I have put off making any changes to the computer that require hardware modifications on a do-it-yourself basis. But I've had this computer for several years now and I get bolder as time goes on, so I decided to

give it a shot. Here are the results of that attempt (written on my operating and high speed TRS-80).

The First Hurdle

When I order by mail I like to receive my order in a reasonable length of time. I usually supply a credit card number to avoid the delay of processing personal checks, but with the recent increase in interest rates I have vowed never again to charge. For this reason I went to the bank and purchased a money order so the speed-up kit could be sent without delay.

After four weeks I got nervous. After six weeks I wrote a letter to find out where my kit was. Eight weeks later to the day, my kit showed up in the mail. I don't know if there were any special problems, but eight weeks is a bit too long.

The Second Hurdle

The documentation leaves something to be desired. It includes 16 pages of instruction (the length is due to the different types of logic boards in the TRS-80). There is also a two page addendum which has numerous changes to the instructions. From experience I can tell you this: Read through the corrections and make them on the original instruction manual whether or not they apply to your board. This will help prevent disastrous errors later on. There is also a full-size photo of the computer's logic board that is marked for easy location of

every connection and trace.

The documentation is a little confusing. Read and understand it before you start. This is not the type of project you just jump into and then back up to correct mistakes. *Do it right the first time!* If you are not familiar with soldering techniques, printed circuit boards and ICs, you should consider having the kit installed by someone who knows what they are doing. It's not impossible for a novice to install the kit; I did it, but it was frustrating as hell. I could install the kit in about an hour now. At the time, it took me four hours of cursing and wondering.

The Kit

The Speed-up kit is composed of a small circuit board that is extremely well made. (See Photo 1 which shows the speed-up board as well as all of the accessory parts.) A twenty wire ribbon cable extends from the speed-up board, and these twenty wires are connected to various points on the computer logic board. In the kit box are a few extra parts: one diode, one LED, one capacitor, one length of wire, a connector/coupler and one length of very fine solder. You may or may not need these parts, depending on board type and whether or not you have an expansion interface and disk drives.

I'm sure you've seen the ads for the Archbold speed-up kit in *80 Microcomputing*. They are a little misleading. The ad doesn't mention that in order to pump up the speed of your computer to the maximum six MHz, you will need a Z-80B CPU to replace the one in your computer. The Z-80 is fine (in most cases) for the three MHz conversion, but you will most likely run into trouble if you go faster. If your Z-80 won't handle the 100 percent increase, up to a \$27 investment in a Z-80A will fix the problem. On the other hand, the Z-80B is rated at six MHz which makes it very fast compared to the Z-80, and the cost is around \$30. Also note that peculiarities between computers may give you

Program Names	Normal Speed	Minimum Speed-up
Busy Work	13 min. 27 sec.	5 min. 3 sec.
ANOVA	41 sec.	20 sec.
Descriptive Stats	9 sec.	7 sec.
For/Next Loops	1 min. 19 sec.	40 sec.

Table 1. Time Comparisons of Some Programs

*"So far I have found only
one operation problem in the
kit modification: keyboard debounce."*

better or worse results and you must remember that all of the above times are subject to those differences.

They also fail to mention that in order to make the Z-80B operative you need a delay line. You can purchase it from Archbold or from a local supply store—either way it runs about \$20. Also, if you have an expansion interface, you need a delay line for that too. Now you are up to about a \$55 increase over and above the price of the kit.

Installation

The installation is not too difficult, but I would like to give potential users a few tips.

1) Be careful soldering. Too much heat is a no-no. Also, too much solder can cause a run or even a thread to bridge between two points that are not supposed to be connected. That will not cause any permanent damage, but the computer won't work and those errors are a real pain to locate.

2) Be extremely careful when you fold the keyboard unit away from the logic board. The connector is sensitive and rough handling can cause an expensive break.

3) Be neat! Little bits of solder or wire in the unit may sit there for a long time. A jolt to the desk or keyboard, and the computer is suddenly down. If you take it to a repair shop they will dust it off and charge you an arm and both legs as well as your first born child.

4) Have all the necessary tools ready when you start to work. You need to be orderly when working with systems as complicated as printed circuit boards.

5) Remember that your computer uses very little power. For that reason there is very little excess power available. When you add accessories that use computer power, you are straining the limits of the computer's regulator. Don't make 300 modifications that all use computer power or the computer will crawl away and die. Use only those that are most important to you.

Does It Work?

The kit does work and you can power up in either high or low speed (a simple modification to the kit board) and then change it to the opposite speed with a simple OUT 254,1 (or 0, depending on which way you want to go). The LED that is included changes color to indicate what mode you are in. Red is normal, green is high speed and yellow is 50 percent slower than normal (50 percent below normal is switch controlled). Also, the board automatically reduces speed when cassette or disk I/O is performed, and then returns to high speed (if that was selected) when the I/O is complete. Note that if manual switching is used, cassette automatic down speed will no longer occur.

If manually switched into high speed,

disk access will cause automatic slow down, but cassette access will require an OUT instruction (or manual switching) to slow the computer. This manual switching makes it possible to run 50 percent slower than normal or high speed. Switching can be done during program operation with no interference in the program's performance; however, the extra work for the minimum benefit seems to me to be a waste of time. The switch is not included in the kit but is readily available at your local supply store.

I tested the speed-up with several programs. See Table 1 for the results for comparison. You will note a substantial increase in operating time between the normal times and the speed-up times due to my 100 percent increase. Not all the speeds are twice as fast, but that is due to the type of operation the computer is doing. The longer programs show 100 percent or better increase in operating time.

Operational Problems

So far I have found only one operational problem in the speed-up kit modification: keyboard bounce. I have the old style Level II, so I need a debounce program. DOS as well as Scripsit have a debounce routine built in. Level II provides numerous debounce routines. The problem is that debounce is accomplished by introducing a time delay in the keyboard scan. That means that if a key double strikes, the second strike will occur before the delay is complete and the keyboard scan is reimplemented. Therefore, the second key strike (bounce) is ignored.

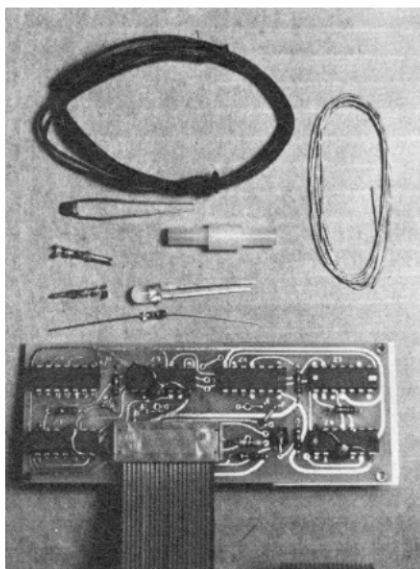


Photo 1. The Archbold Speed-up kit with all accessories.

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"The speed-up manual states that the Archbold speed-up is the best... the manual doesn't lie."

Well, when you speed up the operation you shorten the debounce delay. As a result, I have noticed an occasional keybounce. At my speed-up rate it is not bad, and cleaning the keys seems to have eliminated it altogether. I do see a problem for those who jump up to six MHz, because the delay will be so short as to be totally ineffectual. If you know your debounce program you can increase the delay and solve the problem. If not, you will be stuck! With no debounce and the high speed mod it is likely that the key bounce problem will be magnified. (My experience and testing verifies this.)

There is a bright side to this point that might interest users of Level II with the new ROM based debounce. I have heard complaints that this built-in debounce is too slow, and fast typists can easily outrun it. In that case the high speed will probably make the ROM based debounce a little easier to deal with.

Unexpected Goodies

I have a disk system and I very seldom use my cassette at all. There are, however, a

few games and applications programs that are not disk compatible, so occasionally I run the cassette. After installing the Archbold kit, I wanted to see how it affected an Invaders game. Well, the game ran super fast and posed a real challenge, but I noticed something strange. The cassette loaded the first time with no error. That surprised me because that particular cassette usually took several attempts to load. In fact, I thought that there was a problem with the first program copy on that cassette because it always gave me a checksum error. I usually had to load the second copy and often that didn't work either.

This bit of good fortune started me thinking, so I pulled out some other difficult to load cassettes in both BASIC and System. They all loaded the first time! I won't guarantee that the same will happen in your case, but I suspect that when the speed-up kit is in the normal mode it actually runs a bit slower than the original set-up. For that reason the data transfer is less likely to miss bits and less checksum errors will occur. I may be off base with this conclusion,

but I can say that all my cassettes load. Even ones that I had given up for dead now load fine. Also I have noted that BASIC and System tapes load at the same volume.

Conclusion

The speed-up manual states that the Archbold speed-up is the best available regardless of price. I haven't tried any of the others but I know people who have. Based on what they have said, the manual doesn't lie. I'm very satisfied with the increase speed of operation, and even though the installation was a bit tricky, it was well worth it. If you would like that extra speed, then buy Archbold—it works and it works right! ■

Note: In all fairness to Archbold Electronics I should point out that I ordered my kit from an old advertisement. The March Issue of 80 Micro has a new ad which is more accurate and points out the Z-80A and B options. Also, the price is now up to \$45.00.

Combine accurate flight characteristics with the best in animation graphics and you'll have SubLOGIC's

T80-FS1 Flight Simulator for the TRS-80

SubLOGIC's T80-FS1 is the smooth, realistic simulator that gives you a real-time, 3-D, out-of-the-cockpit view of flight.

Thanks to fast animation and accurate representation of flight, the non-pilot can now learn basic flight control, including take-offs and landings! And experienced pilots will recognize how thoroughly they can explore the aircraft's characteristics.

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Computer and aviation experts call the T80-FS1 a marvel of modern technology. You'll simply call it *fantastic!*

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- 3 frame-per-second flicker free animation
- Maximum transfer keyboard input
- Constant feedback cassette loader

Hardware Requirements:

- Radio Shack TRS-80, Level 1 or 2
- 16K memory
- *Nothing else!*

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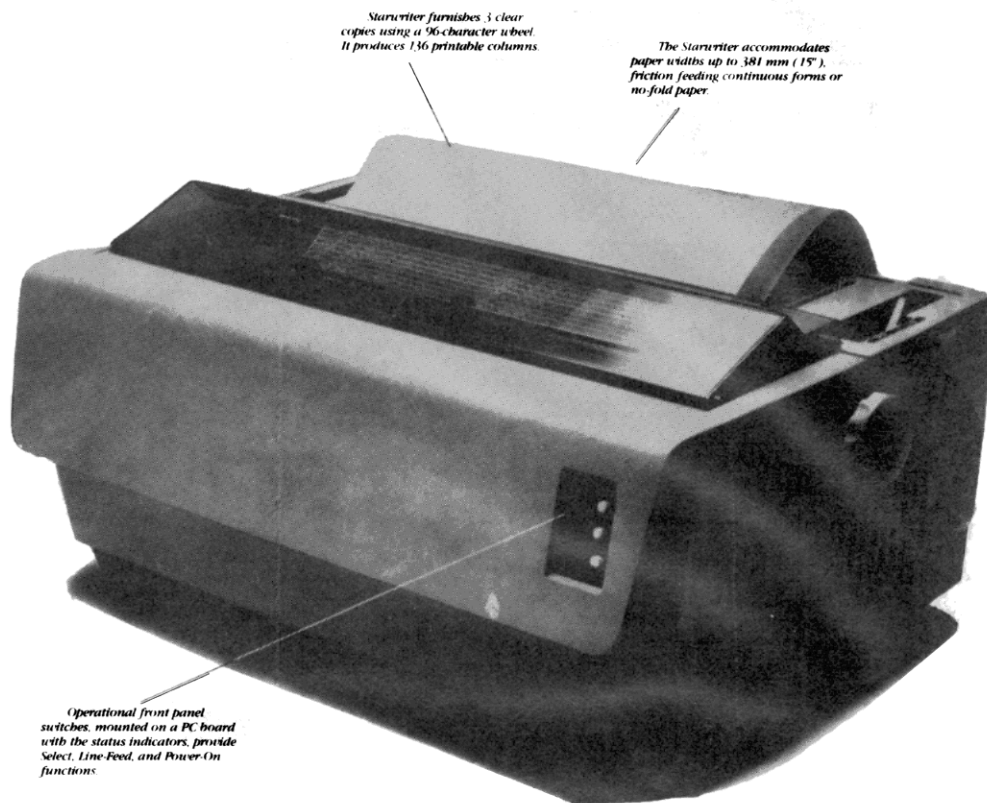
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✓ 150

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The Starwriter Daisy Wheel Printer is designed to fill a distinct gap in the peripheral marketplace. A speed of 25 cps and its low price make it the ideal choice for today's systems designer interested in achieving superior price/performance ratios.

Incorporating the latest LSI technology, the Starwriter is built by one of the world's most respected computer peripheral manufacturers. The printer is furnished complete and ready-to-use, requiring no changes in hardware or software. Starwriter offers an industry standard parallel interface, as well as RS232-C interface. Total plug compatibility and a wide variety of interface matching capabilities help lower the system integration costs for OEMs and end-users.

Using a 96-character wheel, the Starwriter produces letter-quality printing on 3 sharp copies with up to 136 columns. Starwriter offers the highest degree of vertical and horizontal positioning, resulting in the most precise character placement in the industry. The easy-to-change character wheel also makes our printer a perfect choice for international applications. Compatible with sheet feeders, starwriter accommodates paper widths to 381 mm (15") and uses industry standard ribbon cartridges.

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Starwriter is backed up by a one-year warranty (3 months on parts and labor, 9 succeeding months on parts) and is further supported by a strong, fully trained and technically proficient service organization. The Starwriter is available for immediate shipment in any quantity desired.

For more information, call American Business Computer, 118 So. Mill Street, Pryor, Oklahoma 74361; Telephone 918-825-4844.

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Model 1

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American Business Computer NOW offers a fully compatible TRSDOS* operating system. Our System, called CORDOS, runs all 10 MB, Revision B Corvus drives. The Program in this package contains a Master Program which will convert a user's operating system disk (Version 2.0) to an enhanced system capable of the following:

- Completely transparent use of the Corvus Hand Disk Drive
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Price: **\$300.00** with manual

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CORDOS Author — Andy Frederickson
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TEAC DISK DRIVES

We are pleased to announce that we are now able to offer TRS-80 compatible mini disk drives. These drives are fully compatible with TRSDOS, NEWDOS, and NEWDOS 80 PLUS. The TEAC DRIVE is one of the first Japanese disk drives to appear on the American market. In many ways it is quite superior to its American made counterparts.

\$275.⁰⁰

\$570

Dual Drive In One Enclosure
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Two Drive Cable - \$29.95
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A high-precision lead screw method is used for positioning the head to the correct track. Four motor steps are used for move the width of one track. This improved positioning accuracy greatly reduces the possibility of data error.

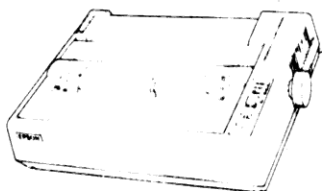
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BUSINESS COMPUTERS



*TM TANDY CORP.

THE MX-80 NOT ONLY DOES EVERYTHING, IT DOES EVERYTHING WELL.



This is the new Epson MX-80 dot matrix printer. It does just about everything you could ask a printer to do. Quickly. Quietly. Reliably. In fact, for OEM installations, the MX-80 may be the single best, all-round printer you can buy. But that's not the best reason to buy it.

The MX-80 prints bidirectionally at 80 CPS in a user-defined choice of 40, 80, 66 or 132 columns. And if that's not fast enough, its logical seeking function minimizes print head travel time. The MX-80 prints 96 ASCII, 64 graphic and eight international characters with a tack-sharp 9x9 matrix. For a long time, Epson printers are known for reliability and the MX-80 is no exception. But that's not the best reason to buy it either.

The print head has a life expectancy of up to 100 x 10⁶ characters, and when it wears out, just throw it away. A new one costs less than \$30 and the only tool you need to change it is attached to the end of your arm. The MX-80 is compact weighs only 12 lbs., and the whole unit, including the two stepper motors controlling carriage and paper feeding functions, is precisely controlled by an internal microprocessor. But even that isn't why you should specify the MX-80.

The best reason is this: because Epson makes more printers than anyone else in the world, we can afford to sell each one for a little less.

...Call For Unbelievably
'Low Price

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OKIDATE MICROLINE 80 PRINTER - \$479

The Microline is built on a rugged cast aluminum base to withstand the rigors of continuous business use. It is driven by two motors and will run all day with no duty cycle limitations. Microline printers use a dense 9 x 7 dot pattern to produce crisp, clean copies, first copy to last. The seven pins in the head are "fired" using energy stored in tension members. This technology permits the use of short, low mass pins made with an extremely hard alloy. The head produces less heat, thereby extending its life. ✓524

★ Check It Out! ★

EPSON MX-80FT

That's right — MX-80FT.

The FT on the end means Friction and Tractor. The Fantastic MX-80 Printer is now available in a version which will accept letterhead-type paper And tractor-type paper. Call or write for our (as always) unbelievable low price. ✓527

AW...WHAT THE HECK RAM Memory Chips for the TRS-80

It is the policy of American Business Computers to offer merchandise at the lowest price possible. Several months back we began selling RAM Memory Chips for the TRS-80 for \$45.00 per set. Someone else sold chips for \$44.00. We sold them for \$38.00. They sold them for \$37.95. So we say "AW WHAT THE HECK!" Let's see the other guys beat this price.

\$22

PER 16K SET

These chips are brand new "4116's". These 200 nanosecond chips are fully compatible with all TRS-80 produces. Instructions for insertion are included, however the dip shunts required for converting a 4K Model I to a 16K Model I are not included at this low price. ✓526

Epson.

This printer costs less than \$450. just how much less we can't tell you - But if you will give us a call we think you will be pleasantly surprised.



This is the Epson MX-70. The lowest priced dot matrix printer you can buy. Now, that in itself should make it very attractive to a lot of people. But you ain't heard the half of it.

To begin with, the MX-70 has a lot more in common with our now-famous MX-80 than just the name. Like unequalled Epson reliability. And technological breakthroughs like the world's first disposable print head. But frankly, the MX-80 packs a lot more power than some people need. So Epson built the MX-70 to be a no-frills printer. At a no-frills price.

But the MX-70 is still a great little printer. They give you 80 CPS unidirectional printing. Top-of-form recognition. Programmable line feed and form lengths. Plain paper printing. An easy-to-read 5x7 matrix. Self test. And an adjustable tractor feed.

That's what you'd expect from a basic little printer. But here's something you wouldn't expect: the finest graphics package on the market today. Free.

They call it GRAFTRAX II. And it means 480 dots across the page, resolution to 60 dots per inch, and a graphic image free of the jitter and overlap that plagues other printers. You get cleaner grays and finer point resolution.

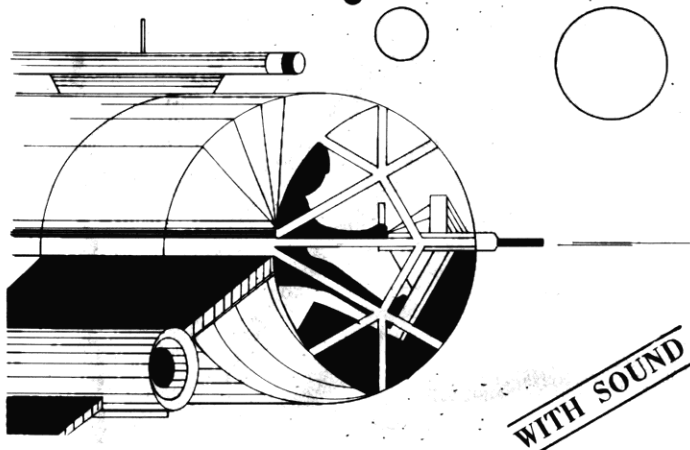
So now you've got a choice. You want more power and extra functions, you buy the MX-80. You want a basic little printer that prints, and keeps on printing, you buy the MX-70. They're both at American Business Computers.

Call for unbelievably low price.

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GO BOLDLY...

Where No TRS-80* Program Has Gone Before!



DANGER IN ORBIT

DATE: 28.02.2047

LOCATION: 270 million miles from Terra

MISSION: Maintaining Terra's Space Lanes

Briefing will follow:

- 1.1 Your mission is to destroy any asteroids in your sector and to prevent alien spacecraft from infiltrating the Terra Defense Network.
- 1.2 Your ship is armed with an anti-matter cannon. You can shoot large asteroids, but this turns them into many smaller asteroids, each capable of destroying your ship.
- 1.3 In addition, alien ships can make in-

stantaneous hyperspace jumps into your area and start firing on your ship.

1.4 You'll need lightning reflexes and nerves of steel to survive Danger In Orbit. We have no use for non-survivors!

Danger In Orbit, a real-time, machine-language game, features variable levels of difficulty, superb high-speed graphics, sound effects and automatic score keeping. (T1 or T2)

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\$14.95 Tape.

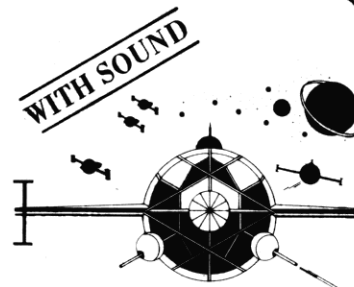
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\$19.95 Disk.

BALL TURRET GUNNER

For years the Petro Resource Conglomerate has attacked our photon collection stations and strangled our deep-space trade routes. The PRC Exxonerator Class light fighters (code name: Gnat) have been their main weapon. Now you can strike back, by joining the Ball Turret Gunner Service.

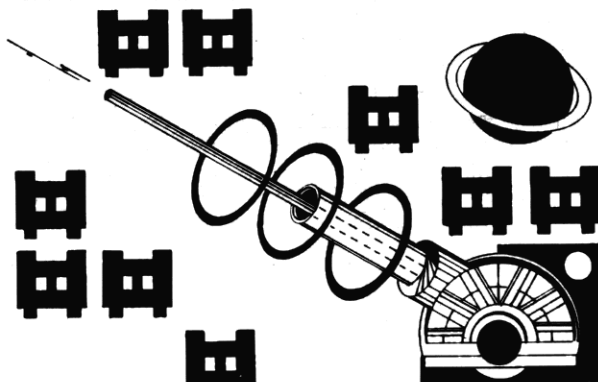
Imagine yourself at the control console of an LW-1417 Stratoblazer (Type B Strategic Laser Weapon). Your Hindsight Director informs you that a Gnat fighter is coming in for an attack. You pivot your gigawatt laser turret until you can see the target on your monitor. The Range Indicator shows him coming in fast. The Targeting Computer studies his course and speed as your finger tenses over the firing key. You know you'll have only a fraction of a second in which to react. The Gnat fighter's evasive maneuvers cause him to dance in your sights. Suddenly,



you see the FIRE Command and you react instinctively. Your laser beam lashes out and reduces the Gnat to an expanding ball of ionized gas. Mission accomplished!

Ball Turret Gunner, with your choice of multiple levels of difficulty, optional sound effects and superb graphics, is more than just a game. It's an adventure. Experience it! (T1)

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ALIEN ATTACK FORCE

The INVADERS are coming! Earth's defenses are dead except for your Laser base. Your assignment is to destroy the approaching INVADERS before they destroy Earth. Before Earth's sensors failed, they detected 550 armed invaders in space, speeding toward us in 10 attack formations of 55 in each group. The sensors detected four different types of attack craft: Large, Medium, Small, and short profile craft which is the most difficult to destroy. If you cannot stop these space attackers they will stop Earth.... for good. (T1)

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COSMIC PATROL

WARNING: PLAYERS OF THIS GAME SHOULD BE PREPARED FOR A STATE OF REALISM HITHERTO UNAVAILABLE ON THE TRS-80

Skilled players soon master many difficult computer games, but COSMIC PATROL is in a world all its own. The challenge intensifies! Supporting graphics and sound (optional) make each encounter an exciting new experience. It all adds up to a Super 3-S package... skill, sight and sound.

Scenario: The Cosmic Patrol program puts you in the command chair of a small interstellar patrol craft. Your mission is to defend Terran space and prey on the Qelon supply ships which carry essential parts and lubricants for that implacably hostile robotic force. The drone freighters

are fairly easy pickings for the accomplished starship pilot, but beware of the I-Fighter escorts. They're armed, fast and piloted by intelligent robots linked to battle computers. They *never* miss.

The Cosmic Patrol program is not just another search and destroy game. With its fast, real-time action, impressive sound option and superb graphics, this machine-language program is the best of its genre.

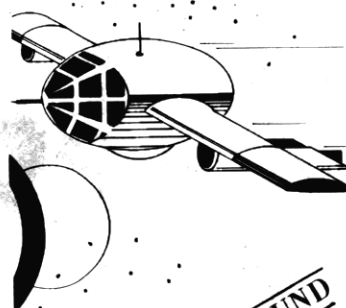
Don't keep putting quarter after quarter into arcade games or spending big bucks for video game cartridges. Get Cosmic Patrol from Instant Software—and get the best for less! (T1 or T2)

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\$19.95 Disk.



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(T1) = TRS-80 Model I, Level II, 16K RAM.

(T2) = TRS-80 Model I, Level II 16K, expansion interface 16K + 1 disk drive.

TO ORDER

See Your Local Instant Software Dealer or Call Toll-Free 1-800-258-5473 (Orders Only)

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Pony programs for the Pocket Computer.

Nag Analysis

Dave Crosby
300 Windsor Drive
Oak Brook, IL 60521

"The way to make a small fortune at the race track is start with a large fortune."

—Anonymous.

With this in mind, I offer you a program for the pocket computer to handicap the nags.

The program considers the following: days between races; distance; class; stretch, gain; call positions; jockey weight; speed rating; and earnings.

The computer takes certain

facts into consideration in helping you to bet. If the horse has not raced in the last 15 days, it is eliminated and you go on to rate the next post position. If it has been 15 days or less, the horse is awarded 10 points. If the distance on today's race is the same as the last time the horse ran, another 10 points are

awarded. Any stretch gain in the last three races gives the horse 10 points.

Call positions are totalled for the last three races and then entered. For example, if the horse was first five times (at any call) in three races, enter 5. The second call works the same way. The computer awards 10 points for a first call, five for a second. Ten points are awarded if the jockey's weight is the same for this race as the last. Enter the speed rating for the last three races and the computer will average them and award points accordingly. The last characteristic is earnings: enter earnings for the year and the number of starts the horse made.

The computer keeps a running total and gives a total for the post position you are working on. When all horses have been rated, you enter 0 for post position and the computer will rank the horses by score. You may want to remove program lines with a pause, to speed things up.

Bet on the horse with the highest rating. ■

Note: The basic idea for the handicap system used in this program was from the book *The Horseplayers Guide to Winning System* by Alec MacKenzie and Bert Randolph Sugar, published by Corwin Books.



```

5 'HANDYCAP PROGRAM FOR TRS-80 POCKET COMPUTER
10 CLEAR
20 INPUT "TODAYS DATE " :A
30 INPUT "DAYS IN PREVIOUS MONTH " :C
40 INPUT "TODAYS DISTANCE " :B :J=0 :L=15
50 INPUT "POST # " :E :IF E=0 THEN 465
55 IF E>15 THEN 50
60 D=0 :IF E > J LET J=E
65 IF E<L LET L=E
70 PAUSE "DAYS BETWEEN RACES "
80 INPUT "LAST RACE DAY " :F :G=A
90 IF F>G LET G=G+C
100 IF (G-F)>15 PAUSE "ELIMINATED" :A(E+27)=0 :A(E+12)=E :GOTO 50
110 I=10 :GOSUB 440
120 INPUT "DISTANCE LAST RACE " :F
130 IF F=B LET I=10 :GOSUB 440 :GOTO 150
140 GOSUB 460
150 PAUSE "CLASS CHECK"
160 INPUT "TODAYS CLAIM " :F
170 INPUT "LAST CLAIM " :G
180 I=INT ((G-F)/100+.5) :GOSUB 440
190 INPUT "GAIN IN STRETCH? (Y/N) " :K
200 IF K="Y" LET I=10 :GOSUB 440 :GOTO 220
210 GOSUB 460
220 PAUSE "RUNNING POSITION"
230 INPUT "1ST ANY CALL " :F
240 INPUT "2ND ANY CALL " :G
250 I=F*10+G*5 :GOSUB 440
260 PAUSE "ASSIGNED WEIGHT"
270 INPUT "WEIGHT THIS RACE " :F
280 INPUT "WEIGHT LAST RACE " :G
290 IF F=G LET I=10 :GOSUB 440 :GOTO 310
300 GOSUB 460
310 PAUSE "LAST 3 SPEEDS "
320 INPUT "FIRST " :F
330 INPUT "SECOND " :G
340 INPUT "THIRD " :H
350 I=INT ((F+G+H)/3+.5) :GOSUB 440
360 PAUSE "AVERAGE EARNINGS"
370 INPUT "YEARS EARNINGS " :F
380 INPUT "NUMBER OF STARTS " :G :IF G=0 LET I=0 :GOTO 400
390 I=INT (F/G+.1) :D=D+I
400 PAUSE "AWARD " :I
410 PRINT "SCORE PP# " :E : IS " :D
420 A(E+12)=E :A(E+27)=D :GOTO 510
440 D=D+I :PAUSE "AWARD " :I
450 PAUSE "SCORE NOW " :D :RETURN
460 PAUSE "NO POINTS AWARDED" :RETURN
465 K$="" :INPUT "SORT? (Y/N) " :K :IF K$="N" THEN 530
470 FOR F=L2 TO J :B=0 :FOR G=L TO J-F
480 IF A(G+27)>A(G+28) THEN 510
490 H=A(G+27) :A(G+27)=A(G+28) :A(G+28)=H
500 H=A(G+12) :A(G+12)=A(G+13) :A(G+13)=H :B=1
510 NEXT G :IF B=0 THEN 530
520 NEXT F
530 FOR F=L TO J :D=F+12 :E=F+27
540 IF A(E)>0 THEN PRINT F : PP# " :A(D) : " POINTS=" :A(E)
550 NEXT F :INPUT "REPEAT? (Y/N) " :K :IF K$="Y" THEN 530
560 GOTO 40

```

Program Listing 1

1. Type R. to start program.
2. For Today's Date and Last Race Day, just enter the day, i.e., 10, 15, 20, etc. for "days in previous month".
3. For distance, enter 6 for six furlongs, 1 for one mile, 1.16 for 1 1/16, etc. The same holds for both distance inputs.
4. For the stretch gain question Y = yes, N = no.
5. Post call is for last three races.
6. When you get the total score for one post position, press Enter for the next post position.
7. When all post positions have been entered, enter 0 for P.P.# question.
8. If you wish horses ranked, answer Y to sort question.

Table 1. Program Notes

Generate assembly listings of machine code with this BASIC program.

A BASIC Disassembler

Frank Delfine
26 Oceanview Ave.
Farmingville, NY 11738

The disassembler presented here generates assembly listings of machine code residing in high memory (approximately 31300 or higher). The program also helps examine the Level II PROMS so we can take advantage of the TRS-80's BASIC routines.

The disassembler is written in BASIC and occupies just under 11K of RAM. Strings and other variable space required to run the program bring the total RAM requirements to about 13K, leaving about 2K of high RAM in a 16K system to load the machine code to be disassembled.

The program drives a line printer; if you have no printer, the LPRINT statements in program line 190 must be changed to PRINTs to send the listing to the screen. The number of lines per page in line 205 should then

be changed from 50 to 15 so as not to scroll the listing off the screen before it can be read.

To make the program more flexible and less aggravating to use, some little extras have been included. The program lets you declare blocks of memory within your specified disassembly range as data so the program will not try to disassemble them. To make it easier to locate these data blocks within the program code, an auxiliary program is included (Program Listing 2) which displays any block of

memory in ASCII on the CRT. An entire machine coded program can be scanned in a few minutes before disassembly. Data tables are usually easy to recognize when the data is presented in this format (i.e., data such as letter strings used for CRT prompts, sequential number strings, patterned data, etc.). The addresses of these tables can be written down and typed into the disassembler later.

If a table is missed by this method, it can usually be spotted in the disassembly listing as

Program Listing 1. DISASM

```

1 CLEAR(1000):DIM I$(255),BL(255):N=0:M=0:GOTO8000
10 CLS:C=0:PRINTTAB(15)"* * * Z-80 DISASSEMBLER * * *"
20 PRINT:INPUT"DUMP TITLE";F$
30 PRINT:INPUT"START ADR (IN DEC)";A
40 INPUT"END ADR (IN DEC)";B
42 PRINT:INPUT"DECLARE ANY DATA SEGMENTS";V$
43 IF V$="Y"GOSUB25000
50 PRINT:INPUT"TURN ON LP THEN 'ENTER'";B$
60 LPRINT" ":LPRINTTAB(20)F$:LPRINT" "
79 Q=A
80 H1=INT(A/4096):H2=INT((A-H1*4096)/256)
90 L1=INT((A-H1*4096-H2*256)/16)
100 L2=A-H1*4096-H2*256-L1*16
111 IF M<>0 GOTO113
112 GOTO120
113 IF A>=A(N)AND A<=B(N)GOTO115
114 GOTO120
115 D=PEEK(A):GOSUB50090:FH$="D":FL$="A":GH$="T":GL$="A"
    TS=I$(D):IS(D)=" "
116 IF A=B(N)THEN N=N+1:M=M-1:GOTO130
117 GOTO130
120 D=PEEK(A):GOSUB600
130 V=D:GOSUB30000
140 DH$=H$:DL$=L$
160 IF H1>=10 GOTO240
165 H1$=STR$(H1):H1$=MID$(H1$,2,1)
170 IF H2>=10 GOTO250
175 H2$=STR$(H2):H2$=MID$(H2$,2,1)

```

```

180 IF L1>=10 GOTO260
182 L1$=STR$(L1):L1$=MID$(L1$,2,1)
185 IF L2>=10 GOTO270
187 L2$=STR$(L2):L2$=MID$(L2$,2,1)
190 LPRINTQ:LPRINTTAB(10):LPRINTUSING"% %!!!!";" ",
    H1$,H2$,L1$,L2$;:
LPRINTUSING"% %!!!!!!!!!!";" ",D
    HS,DL$,EH$,EL$,FH$,FL$,GH$,GL$;:
LPRINTTAB(30)IS(D
)
200 A=A+1:C=C+1:IF A>=B+1 GOTO 400
205 IF C=50 GOTO500
210 IFGH$="T"THEN IS(D)=TS
211 GOTO79
240 X=H1-10+65:H1$=CHR$(X):GOTO170
250 X=H2-10+65:H2$=CHR$(X):GOTO180
260 X=L1-10+65:L1$=CHR$(X):GOTO185
270 X=L2-10+65:L2$=CHR$(X):GOTO190
400 PRINT"* * DUMP COMPLETE * *"
410 INPUT"AGAIN (Y/N)";B$
420 IFB$="Y"GOTO10
425 GOTO530
500 PRINT:PRINT"* * * * END OF PAGE * * * *"
510 INPUT"RELOAD THEN 'ENTER'";B$:C=0:GOTO79
530 END
600 IF D<64 OR D>127 GOTO740
605 IFD=118THENRETURN
610 DH=INT(D/16):DL=D-DH*16
620 G=DLAND7:F=((DAND56)/8)
640 IS(D)="LD "+J$(F)+","

```

Program continues

```

720 IS(D)=IS(D)+JS(G):GOSUB50090:RETURN
740 IFD<128ORD>191GOTO1000
750 DH=INT(D/16):DL=D-(DH*16)
760 G=DLAND7:F=((DAND120)/8)
780 IF F=0 IS(D)="ADD A,"
790 IF F=1 IS(D)="ADC A,"
800 IF F=2 IS(D)="SUB "
810 IF F=3 IS(D)="SBC A,"
820 IF F=4 IS(D)="AND "
830 IF F=5 IS(D)="XOR "
840 IF F=6 IS(D)="OR "
850 IF F=7 IS(D)="CP "
860 IS(D)=IS(D)+JS(G):GOSUB50090:RETURN
1000 IFBL(D)=1GOTO1030
1010 IFBL(D)=2GOTO1040
1020 IFBL(D)=3GOTO1060
1025 IFBL(D)=4GOTO15000
1026 IFD=221ORD=253GOTO26000
1030 GOSUB50090:RETURN
1040 A=A+1:Z=PEEK(A):GOTO2000
1060 A=A+1:Z=PEEK(A):A=A+1:Z1=PEEK(A)
2000 V=Z:GOSUB30000:EH=H$:EL=L$
2070 IF BL(D)=3 GOTO 3000
2080 GOSUB50100:GOTO4000
3000 V=Z1:GOSUB30000:PH=H$:FL=L$
4000 P1$=PH$+FL$+EH$+EL$:P2$=EH$+EL$:GH$="":GL$=" "
4001 F=DAND7:G=DAND56:G=G/8
4002 IFF=6AND(DAND192)=0THENGOTO5010
4003 IFF=2AND(DAND192)=192THEN GOTO5030
4004 IFF=4 GOTO5050
4005 IFF=0AND(G<2)THENGOTO5020
4008 IS(33)="LD HL,"+P1$
4010 IS(34)="LD ("+P1$+"),HL"
4030 IS(50)="LD ("+P1$+"),A"
4040 IS(205)="CALL "P1$
4050 IS(195)="JP "P1$
4060 IS(58)="LD A,("P1$+" "
4070 IS(254)="CP "P2$
4110 IS(42)="LD HL,("P1$+" "
4123 IS(49)="LD SP,"P1$
4129 IS(17)="LD DE,"P1$
4130 IS(16)="DJNZ "P2$
4132 IS(1)="LD BC,"P1$
4135 IS(198)="ADD A,"P2$
4138 IS(206)="ADC A,"P2$
4140 IS(211)="OUT "P2$+"",A"
4142 IS(214)="SUB "P2$
4144 IS(219)="IN A,"P2$
4146 IS(222)="SBC A,"P2$
4149 IS(230)="AND "P2$
4152 IS(238)="XOR "P2$
4155 IS(246)="OR "P2$
4158 RETURN
5010 IS(D)="LD "P2$+JS(G)+"",P2$:RETURN
5020 IFG=3THENIS(D)="JR "P2$:RETURN
5022 G=G-4:IS(D)="JR "P2$+JS(G)+"",P2$:RETURN
5030 IS(D)="JP "P2$+JS(G)+"",P1$:RETURN
5050 IS(D)="CALL "P2$+JS(G)+"",P1$:RETURN
8000 FORS=0TO63:BL(S)=1:NEXTS
8010 FORS=192TO255:BL(S)=1:NEXTS
8020 BL(118)=1:BL(6)=2:BL(14)=2:BL(16)=2:BL(22)=2:BL(24)=2:
BL(30)=2:BL(32)=2:BL(38)=2:BL(40)=2:BL(46)=2:
BL(48)=2:BL(54)=2:
BL(56)=2
8030 BL(62)=2:BL(198)=2:BL(206)=2:BL(211)=2:BL(214)=2:BL(219)=2:
:BL(222)=2:BL(230)=2:BL(238)=2:BL(246)=2:
BL(254)=2
8040 BL(1)=3:BL(17)=3:BL(33)=3:BL(34)=3:BL(42)=3:BL(49)=3:
BL(50)=3:BL(58)=3:BL(194)=3:BL(195)=3:BL(196)=3:BL(202)=3:
BL(204)=3:BL(205)=3:BL(210)=3:BL(212)=3:BL(218)=3:BL(220)=3:
8050 BL(226)=3:BL(228)=3:BL(234)=3:BL(236)=3:BL(242)=3:
BL(244)=3:BL(250)=3:BL(252)=3:BL(203)=4:BL(237)=4:
:BL(221)=0
:BL(253)=0
8070 JS(0)="B":JS(1)="C":JS(2)="D":JS(3)="E":JS(4)="H":
JS(5)="L"
8080 JS(6)="HL":JS(7)="A"
8090 SS(0)="NZ":SS(1)="Z":SS(2)="NC":SS(3)="C":SS(4)="P"
O":
SS(5)="PE":SS(6)="P":SS(7)="M"
8100 PS(0)="SBC HL,"PS(1)="ADC HL,"
8110 PS(2)="SBC HL,"PS(3)="ADC HL,"
8120 PS(4)="SBC HL,"PS(5)="ADC HL,"
8130 PS(7)="ADC HL,"NS(0)="BC":NS(1)="BC":NS(2)="DE"
8140 NS(3)="DE":NS(4)="HL":NS(5)="HL":NS(7)="SP"
8150 LS(0)="N":LS(1)="I":MS(0)="0":MS(2)="1":MS(3)="2"
8160 OS(0)="I,A":OS(1)="R,A":OS(2)="A,I":OS(3)="A,R"
8170 QS(0)="LD":QS(1)="CP":QS(2)="IN":QS(3)="OUT"
9000 IS(0)="NOP":IS(2)="LD (BC),A":IS(3)="INC BC"
9001 IS(7)="RLC A":IS(8)="EX AF,AF"
9002 IS(9)="ADD HL,BC":IS(10)="LD A,(BC)"

```

```

9003 IS(11)="DEC BC":IS(15)="RRC A"
9004 IS(18)="LD (DE),A":IS(19)="INC DE"
9005 IS(23)="RLA":IS(25)="ADD HL,DE":IS(26)="LD A,(DE)"
9006 IS(27)="DEC HL"DE":IS(31)="RRA":IS(35)="INC HL"
9007 IS(39)="DAA":IS(41)="ADD HL,HL":IS(43)="DEC HL"
9008 IS(47)="CPL":IS(51)="INC SP":IS(55)="SCF"
9009 IS(57)="ADD HL,SP":IS(59)="DEC SP":IS(63)="CCF"
9010 IS(43)="DEC HL"
9011 IS(192)="RET NZ":IS(197)="PUSH BC"
9012 IS(199)="RST 0":IS(200)="RET Z":IS(207)=
"RST 8"
9013 IS(208)="RET NC":IS(209)="POP DE"
9014 IS(213)="PUSH DE":IS(215)="RST 10H"
9015 IS(216)="RET C":IS(223)="RST 18H"
9016 IS(224)="RET PO":IS(227)="EX (SP),HL"
9017 IS(231)="RST 20H":IS(232)="RET PE"
9018 IS(233)="JP (HL)":IS(235)="EX DE,HL"
9019 IS(239)="RST 28H":IS(240)="RET P"
9020 IS(201)="RET"
9021 IS(241)="POP AF":IS(243)="DI":IS(245)="PUSH AF"
9022 IS(247)="RST 30H":IS(248)="RET M":IS(251)="EI"
9023 IS(249)="LD SP,HL":IS(255)="RST 38H"
9030 IS(197)="PUSH BC"
9040 IS(193)="POP BC":IS(229)="PUSH HL"
9050 IS(225)="POP HL"
9060 IS(217)="EXX"
9070 IS(118)="HALT"
9080 L=0:FOR D=5TO45STEP8:IS(D)="DEC "P2$+JS(L):L=L+1:NEXT
9090 L=0:FORD=4TO44STEP8:IS(D)="INC "P2$+JS(L):L=L+1:NEXT
9100 IS(60)="INC A":IS(61)="DEC A":GOTO10
15000 IFD=203GOTO15040
15020 IFD=237GOTO40200
15040 A=A+1:Z=PEEK(A)
15050 EH=INT(Z/16):EL=Z-EH*16:G=EL AND 7
15060 F=INT((EL AND 8)/8):F=F+(EH*2):GOSUB15070
15066 GOTO15380
15070 IFF=0IS(D)="RLC ":RETURN
15080 IFF=1IS(D)="RRC ":RETURN
15090 IFF=2IS(D)="RL ":RETURN
15100 IFF=3IS(D)="RR ":RETURN
15110 IFF=4IS(D)="SLA ":RETURN
15120 IFF=5IS(D)="SRA ":RETURN
15130 IFF=7IS(D)="SRL ":RETURN
15140 IFF=8ANDF<=15GOTO15180
15150 IFF=16ANDF<=23GOTO15200
15160 F=FAND7:F$=CHR$(F+48)
15170 IS(D)="SET "P2$+F$+",":RETURN
15180 F=FAND7:F$=CHR$(F+48)
15190 IS(D)="BIT "P2$+F$+",":RETURN
15200 F=FAND7:F$=CHR$(F+48)
15210 IS(D)="RES "P2$+F$+",":RETURN
15380 IF EH>=10 GOTO15430
15390 EH$=STR$(EH):EH$=MID$(EH$,2,1)
15400 IF EL>=10 GOTO15440
15410 EL$=STR$(EL):EL$=MID$(EL$,2,1)
15420 GOSUB50100:IS(D)=IS(D)+JS(G):RETURN
15430 X=EH+55:EL$=CHR$(X):GOTO15400
15440 X=EL+55:EL$=CHR$(X):GOTO15420
20000 IFDAND7=5GOTO20040
20010 IFDAND7=4GOTO20040
20020 GOTO1030
20040 L=DAND56
20050 G=L/8
20130 IFDAND7=5THENIS(D)="DEC "P2$+JS(G):GOTO20150
20140 IS(D)="INC "P2$+JS(G)
20150 GOSUB50090:RETURN
25000 N=1
25010 INPUT"START ADR=":A(N):INPUT"END ADR=":B(N)
25020 INPUT"ANOTHER SEGMENT":V$
25030 IF V$="Y"THEN N=N+1:GOTO25010
25040 M=N:N=1:RETURN
26000 IFD=221THENV$="IX":GOTO26004
26002 V$="IX"
26004 A=A+1:Z=PEEK(A)
26010 IF Z=203 GOTO27000
26020 IFZ>=70ANDZ<=190GOTO40000
26025 IFZ=33ORZ=34ORZ=42GOTO26180
26027 IFZ=52ORZ=53GOTO26280
26028 IFZ=54GOTO26350
26029 V=Z:GOSUB30000:EH=H$:EL=L$:GOSUB50100
26030 IFZ=9 IS(D)="ADD "P2$+V$+",BC"
26040 IFZ=25IS(D)="ADD "P2$+V$+",DE"
26050 IFZ=35IS(D)="INC "P2$+V$+",A"
26060 IFZ=41IS(D)="ADD "P2$+V$+",V$
26070 IFZ=43IS(D)="DEC "P2$+V$+",A"
26080 IFZ=57IS(D)="ADD "P2$+V$+",SP"
26090 IFZ=225IS(D)="POP "P2$+V$+",(SP),V$
26100 IFZ=227IS(D)="EX "P2$+V$+",V$
26110 IFZ=229IS(D)="PUSH "P2$+V$+",V$
26120 IFZ=233IS(D)="JP "P2$+V$+",V$
26130 IFZ=249IS(D)="LD SP,"P2$+V$+"

```

Program continues

```

26150 RETURN
26180 V=Z:GOSUB30000
26190 EH$=H$:EL$=L$
26200 A=A+1:Z1=PEEK(A):V=Z1:GOSUB30000
26210 FH$=H$:FL$=L$:A=A+1
26220 Z1=PEEK(A):V=Z1:GOSUB30000
26230 GH$=H$:GL$=L$
26240 IFZ=33I$(D)="LD"      "+V$+", "+GH$+GL$+FH$+FL$
26250 IFZ=34I$(D)="LD"      (" +GH$+GL$+FH$+FL$+" ), "+V$
26260 IFZ=42I$(D)="LD"      "+V$+", (" +GH$+GL$+FH$+FL$+
) "
26270 RETURN
26280 V=Z:GOSUB30000:EH$=H$:EL$=L$
26300 A=A+1:Z1=PEEK(A):V=Z1:GOSUB30000
26310 FH$=H$:FL$=L$:GH$="":GL$="
26320 IFZ=52I$(D)="INC"      (" +V$+" +FH$+FL$+" )
26330 IFZ=53I$(D)="DEC"      (" +V$+" +FH$+FL$+" )
26340 RETURN
26350 V=Z:GOSUB30000:EH$=H$:EL$=L$
26370 A=A+1:Z1=PEEK(A):V=Z1:GOSUB30000
26380 FH$=H$:FL$=L$:A=A+1
26390 Z1=PEEK(A):V=Z1:GOSUB30000
26400 GH$=H$:GL$=L$
26410 I$(D)="LD"      (" +V$+" +FH$+FL$+" ), "+GH$+GL$
26420 RETURN
27000 A=A+1:EH$=CHR$(67):EL$=CHR$(66)
27010 V=PEEK(A):GOSUB30000
27020 FH$=H$:FL$=L$
27050 A=A+1:Z2=PEEK(A):O=Z2AND248:O=O/8
27055 Q$=" (" +V$+" +FH$+FL$+" )
27060 F=O:GOSUB15070
27070 I$(D)=I$(D)+Q$
27080 V=Z2:GOSUB30000:GH$=H$:GL$=L$:RETURN
30000 H=INT(V/16):L=V-(H*16)
30010 IFH>=10 GOTO30060
30020 H$=STR$(H):H$=MID$(H$,2,1)
30030 IF L>=10GOTO30070
30040 L$=STR$(L):L$=MID$(L$,2,1):RETURN
30060 X1=H+55:H$=CHR$(X1):GOTO30030
30070 X1=L+55:L$=CHR$(X1):RETURN
40000 V=Z:GOSUB30000:EH$=H$:EL$=L$:GH$="":GL$="
40020 A=A+1:Z1=PEEK(A)
40030 V=Z1:GOSUB30000:FH$=H$:FL$=L$
40050 IF Z=126THENI$(D)="LD"      A, (" +V$+" +FH$+FL$+
) ":RETURN
40060 P=ZAND240
40070 IF P=112GOTO40140
40080 IF P>=128 GOTO40170
40090 P=ZAND56:P=P/8:GOSUB50000
40120 I$(D)="LD"      "+G$+", (" +V$+" +FH$+FL$+" ):RET
URN
40140 P=ZAND7:GOSUB50000
40150 I$(D)="LD"      (" +V$+" +FH$+FL$+" ), "+G$:RETURN
40170 P=ZAND56:P=P/8:GOSUB50000
40180 I$(D)=I$(D)+V$+" +FH$+FL$+" )
40190 RETURN
40200 A=A+1:Z=PEEK(A):V=Z:GOSUB30000:EH$=H$:EL$=L$
40210 IFZ=67ORZ=75ORZ=83ORZ=91ORZ=115ORZ=123THEN40450
40220 GOSUB50100:F=ZAND248:G=ZAND7
40230 IFF=160GOTO40410
40240 IFF=168GOTO40420
40250 IFF=176GOTO40430
40260 IFF=184GOTO40440
40270 F=ZAND56:F=F/8:G=ZAND7
40280 IFF=6I$(D)="SBC"      HL,SP":RETURN
40290 IFF=0I$(D)="IN"      "+J$(F)+", (C)":RETURN
40300 IFF=1I$(D)="OUT"      (C), "+J$(F)":RETURN
40310 IFF=2I$(D)=P$(F)+N$(F):RETURN
40320 IFF=4I$(D)="NEG":RETURN
40330 IFF=5I$(D)="RET"+L$(F):RETURN
40340 IFF=6I$(D)="IM"      "+M$(F)":RETURN
40350 IFF<>7I$(D)="* * *":RETURN
40360 IFF<=3GOTO40400
40370 IFF=4I$(D)="RRD":RETURN
40380 IFF=5I$(D)="RLD":RETURN
40390 GOTO40350
40400 I$(D)="LD"      "+O$(F)":RETURN
40410 I$(D)=Q$(G)+"I":RETURN
40420 I$(D)=Q$(G)+"D":RETURN
40430 I$(D)=Q$(G)+"IR":RETURN
40440 I$(D)=Q$(G)+"DR":RETURN
40450 A=A+1:Z1=PEEK(A):V=Z1:GOSUB30000:FH$=H$:FL$=L$
40460 A=A+1:Z1=PEEK(A):V=Z1:GOSUB30000:GH$=H$:GL$=L$
40470 GG$=GH$+GL$+FH$+FL$
40480 IFZ=67I$(D)="LD"      (" +GG$+" ),BC":RETURN
40490 IFZ=75I$(D)="LD"      BC, (" +GG$+" ):RETURN
40500 IFZ=83I$(D)="LD"      (" +GG$+" ),DE":RETURN
40510 IFZ=91I$(D)="LD"      DE, (" +GG$+" ):RETURN
40520 IFZ=115I$(D)="LD"      (" +GG$+" ),SP":RETURN
40530 IFZ=123I$(D)="LD"      SP, (" +GG$+" ):RETURN
50000 IF P=0 THEN G$="B":I$(D)="ADD"      A, ("
50010 IF P=1 THEN G$="C":I$(D)="ADC"      A, ("
50020 IF P=2 THEN G$="D":I$(D)="SUB"      (
50030 IF P=3 THEN G$="E":I$(D)="SBC"      A, ("
50040 IF P=4 THEN G$="H":I$(D)="AND"      (
50050 IF P=5 THEN G$="L":I$(D)="XOR"      (
50060 IF P=6 THEN G$="***":I$(D)="OR"      (
50070 IF P=7 THEN G$="A":I$(D)="CP"      (
50080 RETURN
50090 EH$="":FH$="":FL$="":GH$="":GL$="":RETURN
50100 FH$="":FL$="":GH$="":GL$="":RETURN

```

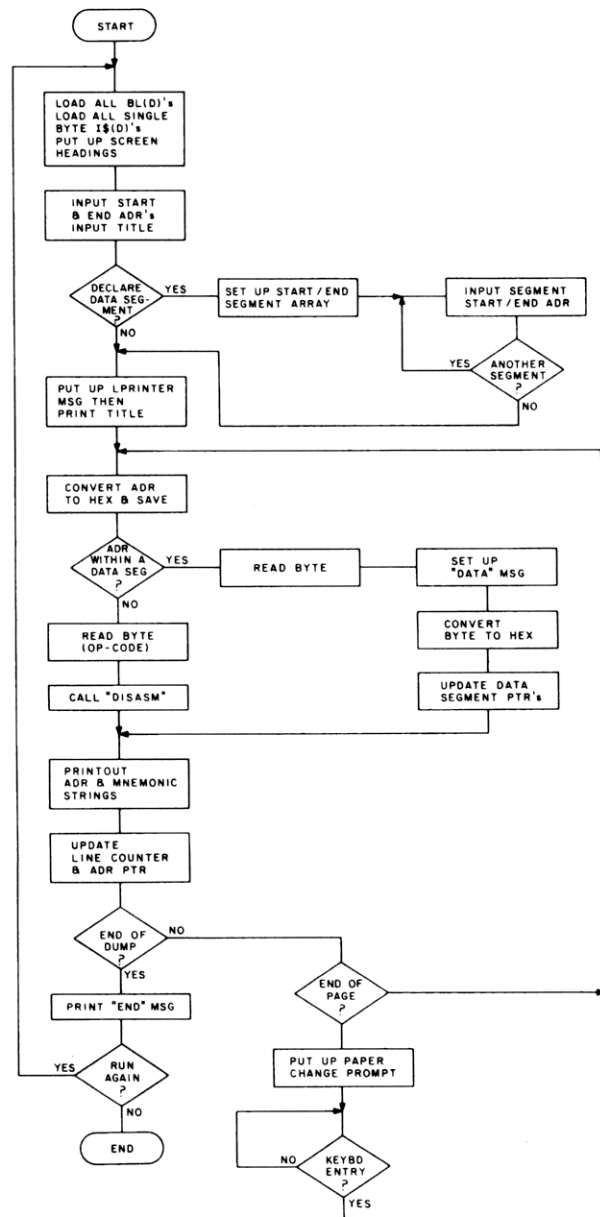


Fig. 1.

a run of instructions that don't make much sense in a particular section of the program. With practice, these things can be spotted quickly. To make print-out paging easier, the program will stop after printing 50 lines and prompt you to reload the printer before continuing.

Once the machine code to be disassembled is loaded into memory, you may generate a listing by running the program and answering the following questions:

DUMP TITLE:?—You can specify a title for the first page.

START ADR(IN DEC):?—Specify the first address to disassemble (in decimal form).

END ADR(IN DEC):?—Specify

the last address to disassemble (in decimal form).

DECLARE ANY DATA SEGMENTS?—Answer Y or N. If Y, the following message will appear.

START ADR = ?—Answer with the first address of the code you wish to declare as data.

END ADR = ?—Answer with the end address of the data segment

ANOTHER SEGMENT?—If you respond with Y the START/END ADR messages will repeat for another data segment. If you answer with N the following message will appear. (This is where the program would have gone had you entered N to the

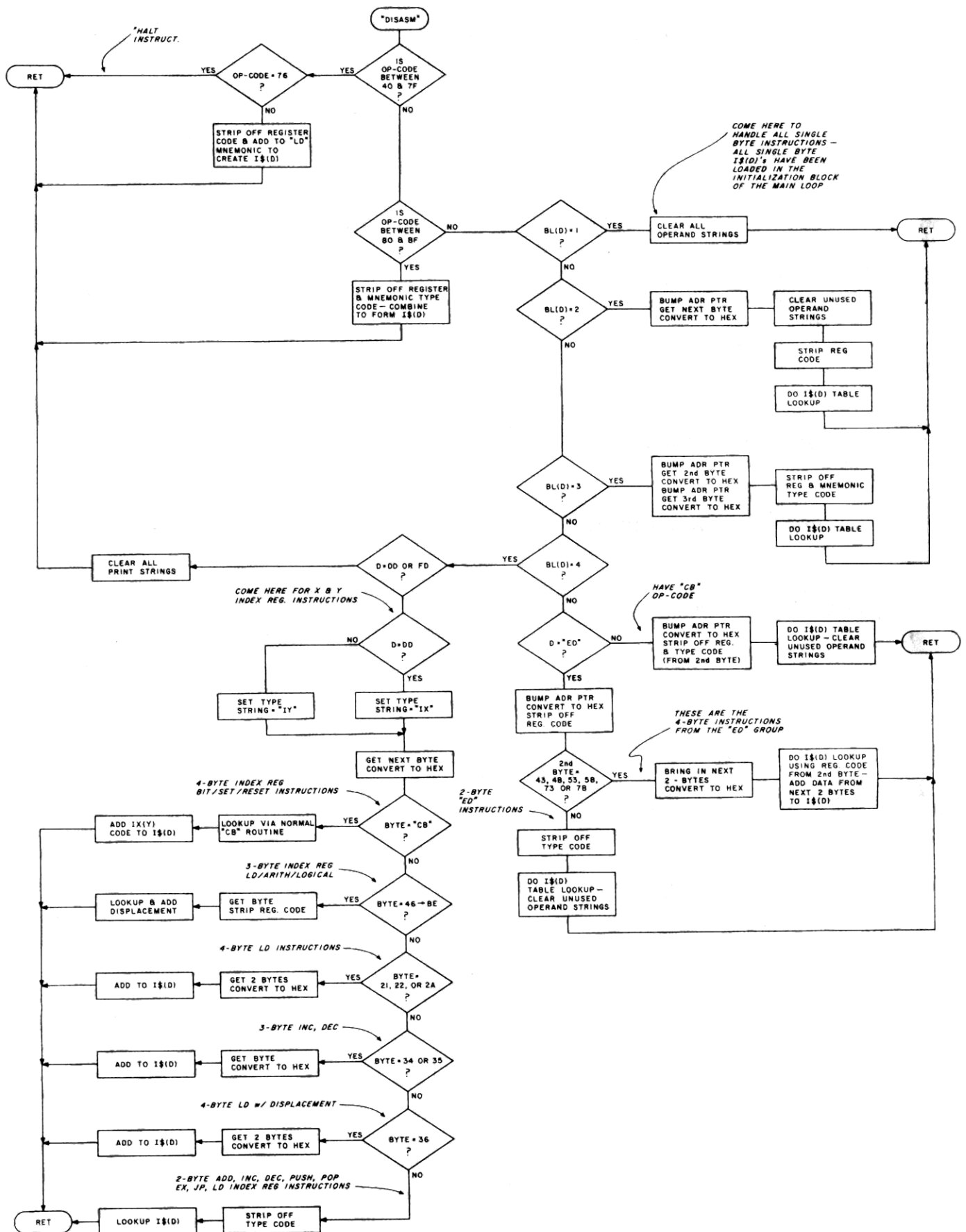


Fig. 2.

DECLARE ANY DATA SEGMENTS question.)

TURN ON LP THEN 'ENTER'?—Be sure the printer is on, then press the Enter key. The listing will then be directed to the line printer.

To keep program length to a minimum, unnecessary spaces are deleted and many instructions are crammed onto a single line. This makes the program difficult to read, so take care when you type the code in. A bit more memory may be conserved if the number of spaces between the instruction mnemonic and the operand are reduced in all the instruction strings (i.e., all I\$(D) strings). This will crowd the printout, but may be worth it if you need the extra space.

The addresses in the listing are in both hex and decimal to make it easier to go back and POKE different values into a location for experimentation or debugging of modified software. This program can be used in conjunction with EDTASM or a similar Z-80 assembler to re-

cate machine code programs.

Program Description

The program is divided into a main loop and a large subroutine called DISASM (see flow chart). The main loop sequences the address pointer through memory, prints the disassembled code and decides whether the pointer is within a declared data segment. DISASM does the actual disassembly.

The output statement is formatted as in Table 2.

DISASM determines values for EH\$,EL\$,FH\$,FL\$,GH\$,GL\$ and I\$(D) while the main loop handles Q,H1\$,H2\$,L1\$,L2\$,DH\$,DL\$. All single byte instruction mnemonics are loaded into memory during the initialization of the main loop. At this time an array called BL(D) is also loaded. This array holds a value for each op-code (0-255) which is used by DISASM to route the program to the proper routine for disassembly. In most cases this value corresponds to the instruction byte length, but there

are exceptions (mainly in the DD,ED and FD instructions which are variable in byte length).

A few smaller arrays (JS(0-7), SS(0-7), PS(0-7), NS(0-7), OS(0-3) and QS(0-3)) are also loaded at this time and are included in order to make some of the other values of I\$(D) more universal. They contain some common suffixes which are concatenated with the same I\$(D) value to form a number of different instructions, thereby saving I\$(D) string space.

The program is rather long

and therefore does not leave much space for machine code programs over about 2K (in a 16K system). It resides in low RAM which is where a lot of Radio Shack's canned programs are written (i.e., EDTASM and T-BUG) so unless these programs are copied to higher memory they cannot be disassembled by this program.

Another point to consider which may or may not be objectionable is execution speed. Since the program is in BASIC and a lot of string operations are being performed, some instruc-

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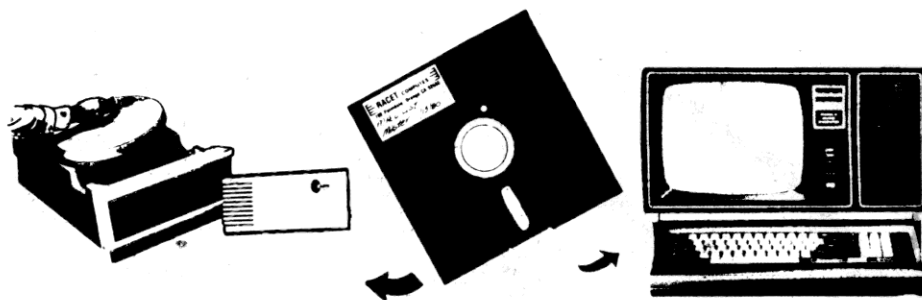
A	ADDRESS POINTER
B	END ADDRESS POINTER
C	LINE COUNTER
D	1ST DATA BYTE (CAN BE OP-CODE OR DATA)
F,G	USED TO STORE REGISTER MNEMONIC TYPE CODES
L,M,N	GENERAL COUNTER VARIABLE
P	USED TO HOLD REGISTER CODE
Q	TEMP STORAGE FOR DECIMAL VALUE OF ADR PTR
S	GENERAL COUNTER VARIABLE
X	TEMP STORAGE IN HEX CONVERSION ROUTINES
Z	USED FOR TEMP STORAGE OF 2ND DATA BYTE
H1,H2	HEX VERSION OF HIGH ORDER ADR BYTE
L1,L2	HEX VERSION OF LOW ORDER ADR BYTE
Z1	TEMP STORAGE OF 3RD DATA BYTE
Z2	TEMP STORAGE OF 4TH DATA BYTE
A(N)	START ADDRESS ARRAY FOR DATA SEGMENTS
B(N)	END ADDRESS ARRAY FOR DATA SEGMENTS
BL(D)	INSTRUCTION BYTE LENGTH ARRAY
BS	GENERAL PURPOSE STRING
FS	DUMP TITLE STRING
HS	HOLDS ASCII VERSION OF LSB IN HEX CONV ROUTINE
LS	HOLDS ASCII VERSION OF MSB IN HEX CONV ROUTINE
QS,VS	GENERAL PURPOSE STRING
DH\$	MSB OF 1ST BYTE (ASCII REPRESENTATION)
DL\$	LSB OF 1ST BYTE (ASCII REPRESENTATION)
EH\$	MSB OF 2ND BYTE (ASCII REPRESENTATION)
EL\$	LSB OF 2ND BYTE (ASCII REPRESENTATION)
FH\$	MSB OF 3RD BYTE (ASCII REPRESENTATION)
FL\$	LSB OF 3RD BYTE (ASCII REPRESENTATION)
GH\$	MSB OF 4TH BYTE (ASCII REPRESENTATION)
GL\$	LSB OF 4TH BYTE (ASCII REPRESENTATION)
H1\$	MSB OF HIGH ORDER ADDRESS (ASCII REPRESENTATION)
H2\$	LSB OF HIGH ORDER ADDRESS (ASCII REPRESENTATION)
L1\$	MSB OF LOW ORDER ADDRESS (ASCII REPRESENTATION)
L2\$	LSB OF LOW ORDER ADDRESS (ASCII REPRESENTATION)
P1\$	CONCATENATION OF FH\$ + FL\$ + EH\$ + EL\$
P2\$	CONCATENATION OF EH\$ + EL\$
I\$(D)	INSTRUCTION MNEMONIC STRING ARRAY
JS(N)	ARRAY HOLDING ASCII VERSION OF REGISTER CODES
LS(N)	HOLDS ASCII "N" AND "I"
MS(N)	HOLDS ASCII "0", "1" AND "2"
NS(N)	ARRAY HOLDING ASCII VERSION OF REGISTER PAIRS
OS(N)	HOLDS ASCII "I,A","R,A","A,I","A,R"
PS(N)	HOLDS ASCII MNEMONICS FOR "SBC HL"&"ADC HL"
QS(N)	HOLDS ASCII "LD","CP","IN","OUT"
SS(N)	ARRAY HOLDING ASCII CODES FOR CONDITIONAL INSTRUCTIONS (I.E. "NZ", "Z", "NC", ETC.)

Table 1. Variables and Arrays

VARIABLE:	Q	H1,2\$/L1,2\$	DH,LS/EH,LS/FH,LS/GH,LS	I\$(D)
DESCRIPT:	DEC	4 CHR HEX ADR	1st-4th DATA BYTES	MNEMONIC STRING
		ADR	(1st byte = OP-CODE)	

Table 2. DISASM Output Statement

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tions can take several seconds to be processed. These difficulties could be minimized were the program written in machine code. However, I'll leave this for another time. I have included a list of the variables used for those who would like to experi-

ment or try to make the code more compact. If an 8080-only version of the program is all that is necessary it can be made considerably shorter. The program presented here will generate mnemonics for 697 instructions. ■

```
10 CLS:C=0:INPUT"ENTER START ADDRESS(DEC)";A
20 INPUT"ENTER END ADDRESS(DEC)";B
30 CLS
40 Z=PEEK(A)
41 IF Z<32 GOTO50
42 IF Z>94 GOTO50
43 PRINTA,CHR$(Z)
44 GOTO70
50 A=A+1:IF A>=B GOTO100
55 GOTO40
60 PRINTA,CHR$(Z)
70 IF A>=B GOTO100
80 A=A+1:C=C+1:IF C=15 GOTO120
90 GOTO40
100 PRINT"RUN ENDED....."
110 END
120 INPUT"PAGE FULL...HIT ANY KEY TO CONTINUE";S$
130 C=0:GOTO40
```

Program Listing 2. ASCII Display Program

0	0000	F3	DI	
1	0001	AF	XOR	A
2	0002	C37406	JP	0674
5	0005	C30040	JP	4000
8	0008	C30040	JP	4000
11	000B	E1	POP	HL
12	000C	E9	JP	(HL)
13	000D	C39F06	JP	069F
16	0010	C30340	JP	4003
19	0013	C5	PUSH	BC
20	0014	0601	LD	B,01
22	0016	182E	JR	2E
24	0018	C30640	JP	4006
27	001B	C5	PUSH	BC
28	001C	0602	LD	B,02
30	001E	1826	JR	26
32	0020	C30940	JP	4009
35	0023	C5	PUSH	BC
36	0024	0604	LD	B,04
38	0026	181E	JR	1E
40	0028	C30C40	JP	400C
43	002B	111540	LD	DE,4015
46	002E	18E3	JR	E3
48	0030	C30F40	JP	400F
51	0033	111D40	LD	DE,401D
54	0036	18E3	JR	E3
56	0038	C31240	JP	4012
59	003B	112540	LD	DE,4025
62	003E	18DB	JR	DB
64	0040	C3D905	JP	05D9
67	0043	C9	RET	
68	0044	00	NOP	
69	0045	00	NOP	
70	0046	C3C203	JP	03C2
73	0049	CD2B00	CALL	002B
76	004C	B7	OR	A
77	004D	C0	RET	NZ
78	004E	18F9	JR	F9
80	0050	0D	DEC	C
81	0051	0D	DEC	C
82	0052	1F	RRA	
83	0053	1F	RRA	
84	0054	01015B	LD	BC,5B01
87	0057	1B	DEC	DE
88	0058	0A	LD	A,(BC)
89	0059	1A	LD	A,(DE)
90	005A	08	EX	AF,AF'
91	005B	1809	JR	09
93	005D	19	ADD	HL,DE
94	005E	2020	JR	NZ,20

Program Listing 3. Sample Disassembly Listing

Get Level I printouts from Level II.

LList For Level I

Everett Ogden
16 Herber Ave.
Delmar, NY 12054

One of the many shortcomings of Level I is the difficulty of obtaining a printout of a program. Radio Shack has a screen printer, but the image leaves a lot to be desired. The method described here requires you have access to a Level II with a printer. That may not be an insurmountable obstacle.

If you belong to a computer club you probably know someone with that equipment. Schools that use the TRS-80 for training are likely to have both systems and, if you can't find a Level II and printer any other way, you may be able to talk your local Radio Shack store into letting you use theirs.

Using Level II's CONV, you can convert Level I programs to Level II, but that will expand abbreviated statements and change PRINT AT to PRINT @. It's easy, however, to get a true listing of the Level I version.

CONV checks a list of Level I statements to see which of them are used in the program. If the part of the program it is working on is not on the list, it leaves it intact and goes on. At the end of the list is a jump address if no match is found. If this

address is moved to the head of the list, no match will ever be found and no conversions performed.

When you have found your Level II do the following:

- Load the Level I/Level II conversion program, but do not jump to it. Return to the BASIC monitor.
- Enter the following instructions:

POKE 32468, 251
POKE 32469, 222

This puts the "no match" address at the head of the list.
• Now jump into CONV and follow the normal conversion procedure. The entry address is 31478.

When you list the program you will find that it is still in Level I format. You can now LLIST it. Don't try to run it, though, because Level II will hang up on the abbreviations and PRINT AT statements. Statements that were written out in full will have been properly converted to Level II tokens because that is done in another part of the program.

I discovered this idea while converting a program that used the abbreviation M. (MEM). It hung up on that line, and when I listed it I saw M. had not been converted. When I disassembled CONV, I found out why: Radio Shack left that word out! ■

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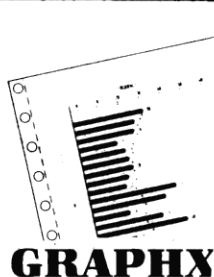
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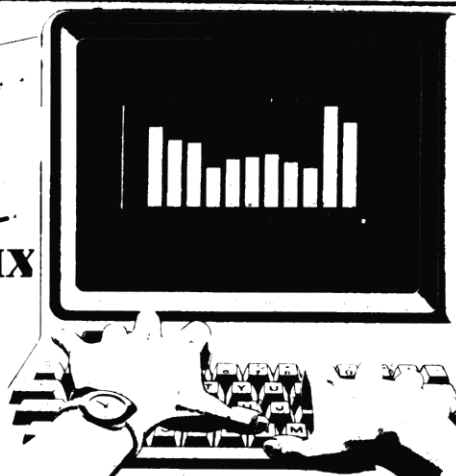
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I'll use two variables, considering the traditional problem of height and weight. We'll test a

group of people to determine what the relation of height to weight is, and use the results to predict the weight of someone with a known height. Collecting data from ten people, we produce Table 1.

Use the variable X for the height, and the variable Y for the weight. Also, attach a subscript to each data value or pair of values, so that X_5 will correspond to the height of the fifth person, and the height and weight of the third person can be represented as X_3, Y_3 .

The next step is to plot each pair of points. Since we want to determine a person's weight, given his or her height, we'll call Y the dependent variable, and plot it on the Y axis. The set of plotted points forms a scatter diagram.

We don't need to plot a scatter diagram to find the best fitting straight line through the data points. The scatter diagram will be useful when determining if a straight line is the best curve to fit.

A straight line appears to fit the scatter diagram in Fig. 1 about as well as any other curve. I've drawn one in, guessing at where it would be. This free-hand method won't be good enough for all applications, and we'll want to code a program to find the best fitting line.

The equation for a straight line is $Y = a + bX$, where a is the Y intercept (the place where the line crosses the Y axis), and b is the slope (the angle the line makes with the X axis).

The Y intercept is difficult to guess at, since our scatter diagram is not drawn so the origin is in correct perspective.

We'll guess that the Y intercept is about -90. The slope will be easier to estimate, since our "guess line" goes through two data points in the scatter diagram. One point has an X value of 54 and a Y value of 100, the other point has an X value of 66 and a Y value of 150. Therefore:

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{150 - 100}{66 - 54} = 4.16667$$

The method we'll use to find the best fitting line is called the method of least squares. We'll take the sum of the distances between each point and the line, squared, move the line around until the sum is minimized, and call this the best fitting line. The resulting line is also called a regression curve of Y on X, since Y is the dependent variable in this example.

Now code a BASIC program to calculate a and b. First determine the maximum number of data values so we can code the DIMension statement. We'll use 100 valid data points; if you have more, raise the vector sizes in the DIM statement. We'll use the trailer principle, so we'll have to DIMension an additional storage location to hold the trailer value.

```
10 DIM X(101), Y(101)
```

Key the data pairs into a program statement, and get into a loop to read the values. You may alter the program so that you can enter the X values all at once, then enter the Y values. I'm going to enter the data values as pairs ($X_1, Y_1; X_2, Y_2; X_3, \dots, Y_n$).

Inside the loop we'll determine whether the first number in

Subject No.	Height (in)	Weight (lbs)
1	54	100
2	72	160
3	60	150
4	74	195
5	62	110
6	75	180
7	66	135
8	57	135
9	66	150
10	60	120

Table 1. Height-weight Chart

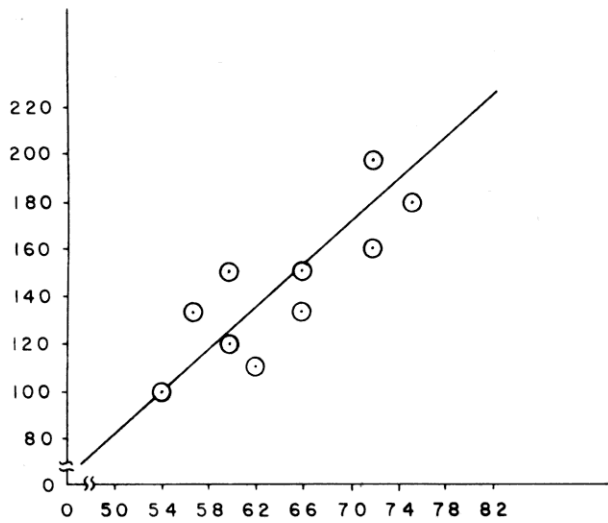


Fig. 1. Plot Diagram

a pair is negative. If it is, we've found the trailer, and can exit the loop. Subtract one from the loop index after exit. The result will be stored in variable N, and tells us how many pairs of data values we have.

Let's assume our data is always positive. If your data doesn't fit this assumption, change the value of the trailer so that it is "more negative" than your smallest data value. You may want to set up a permanent trailer value of some very large negative number.

```
20 FOR I=1 TO 101
30 READ X(I), Y(I)
40 IF X(I)<0 THEN 60
50 NEXT I
60 N=I-1
70 DATA 54,100,72,160,60,150,74,195
71 DATA 62,110,75,180,66,135,57,135
72 DATA 66,150,60,120,-1,-1
```

Data statements can go any-

where in the program, but there is one trick. You'll notice that I've used two trailer values; the READ statement in line 30 expects to read two values—if it doesn't, it won't go to line 40 to check for the trailer. The second trailer value could be any number.

The program, thus far, will have loaded the first 11 locations of the X and Y vectors with their data values, and returned a value of 10 for N. (The eleventh value in each of the two vectors will be the trailer value, a -1.)

Next Step

The next step is to calculate the values of a and b in the equations given earlier.

$$a = \frac{(\sum Y)(\sum X^2) - (\sum X)(\sum XY)}{N\sum X^2 - (\sum X)^2}$$

$$b = \frac{N\sum XY - (\sum X)(\sum Y)}{N\sum X^2 - (\sum X)^2}$$

Note: I've used some shortcut notation: Every time you see the Σ symbol, it means to sum all values of the corresponding variable. In other words:

$\sum XY$ means:

$$\sum_{i=1}^n X_i Y_i$$

The formulae indicate that we need to find four sums: the Y values, the X values, the XY values, and the X² values. The formulae don't show the sum of the Y² values, but we're going to find it anyway, to use later.

Name the variables and then code the summation process:

Sum of X values	SX
Sum of Y values	SY
Sum of X ² values	X2
Sum of Y ² values	Y2
Sum of XY values	XY

BASIC automatically puts a value of zero into each variable, so you can skip lines 80 through 84 if you wish.

```
80 SX=0
81 SY=0
82 X2=0
83 Y2=0
84 XY=0
```

```
90 FOR I=1 TO N
100 SX=SX+X(I)
110 SY=SY+Y(I)
120 X2=X2+X(I)*X(I)
130 Y2=Y2+Y(I)*Y(I)
140 XY=XY+X(I)*Y(I)
150 NEXT I
```

The denominators are the same in the equations for calculating a and b. We have to calculate this only once, and call the results D. We then continue to

calculate a and b.

```
160 D=N*X2-SX*SX
170 A=(SY*X2-SX*XY)/D
180 B=(N*XY-SX*SY)/D
190 PRINT "Y-INTERCEPT="; A
200 PRINT "SLOPE="; B
210 PRINT
220 PRINT "EQUATION OF
    BEST FITTING LINE:"
230 PRINT
240 PRINT " Y="; A; "+ "; B; " * X"
250 PRINT
```

If you key in the program with the test data, you should get a Y intercept of -84.4519 and a slope of 3.52867. The equation is: $Y = -84.4519 + 3.52867 X$. We weren't too far off with guesses of -90 and 4.16. The best fitting line is one that is rotated slightly clockwise from the guess line we drew.

Now that we know the equation of the best fitting line, we can use it to predict values of Y (weight) when given values of X (height). For example, assume someone is 5'10" tall. This is 70 inches; we'd enter the equation with an X value of 70.

$$Y = -84.4519 + (3.52867 * 70)$$

$$= -84.4519 + 247.007$$

$$= 162.555 \text{ lbs.}$$

We can get the computer to do this for us with a little more coding:

```
260 INPUT "WANT TO PREDICT Y VALUES
    ? (1= YES, 0= NO)"; K
270 IF K=0 THEN 320
280 INPUT "ENTER AN X VALUE"; XX
290 YY=A+B*XX
300 PRINT " PREDICTED Y IS: "; YY
310 GO TO 260
320
```

Note: I used XX and YY in this

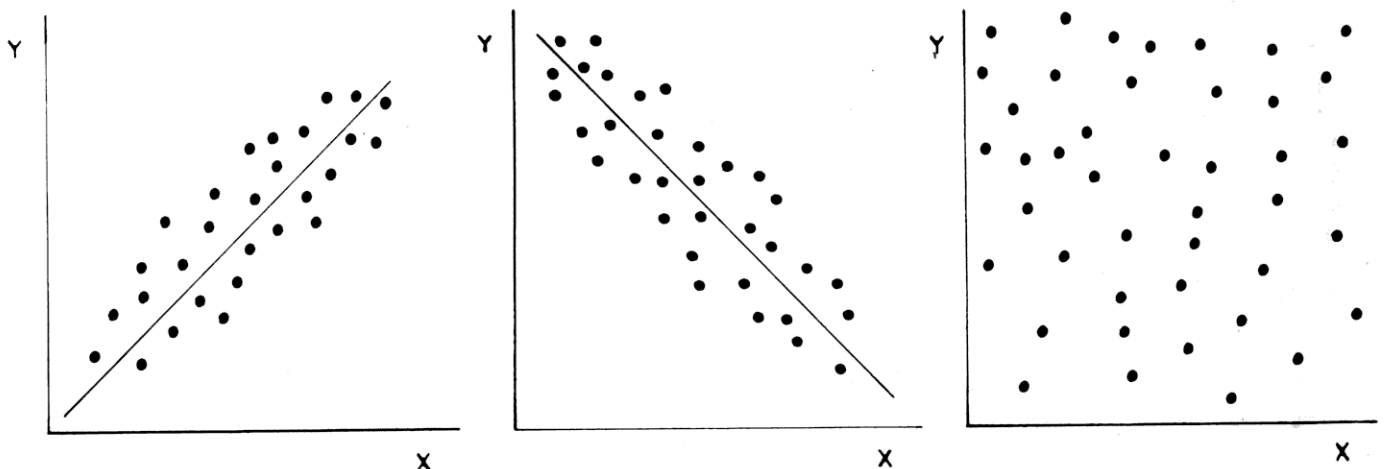


Fig. 2. Positive, Negative and Uncorrelated Variable Diagrams

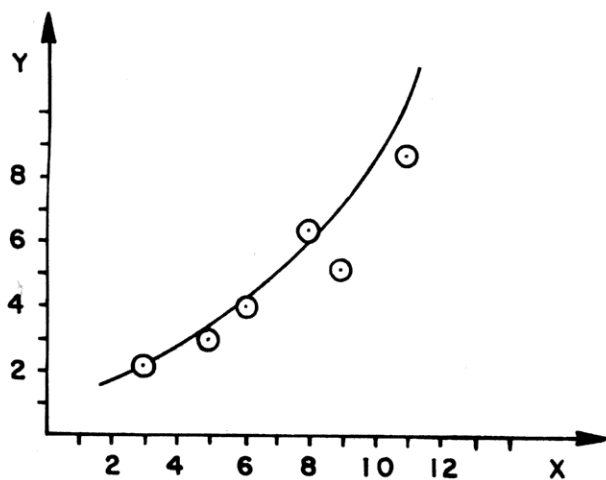


Fig. 3. Scatter Diagram of Quadratic Curve

segment, since X and Y have been used for other purposes in the program. In fact, they are each dimensioned variables, and have 101 locations each.

Correlation

In our example, the value of Y increased as the value of X increased. This is a positive, or direct, correlation. If the value of Y decreased as the value of X increased, it would be a negative, or inverse, correlation. If there didn't seem to be any relation between the two variables, this would suggest no correlation (uncorrelated). These cases are illustrated in Fig. 2.

We can go one step farther, and say that each of the first two examples has a linear correlation—there is a linear relationship between the variables, and a straight line would be the best choice for a regression equation.

A popular way to measure the degree of correlation is by calculating the coefficient of correlation r which can assume any value between -1 and $+1$. A value of -1 indicates a negative correlation in which all data values lie on the regression line. A value of $+1$ indicates a positive correlation in which all data values lie on the regression line. An r value of zero indicates an uncorrelated relationship. In our example we'd expect an r value somewhere between zero and $+1$, since there is a positive correlation between height and weight, but all values do not lie on the regression line.

$$r = \frac{NXY - (\Sigma X)(\Sigma Y)}{\sqrt{(N\Sigma X^2 - (\Sigma X)^2)(N\Sigma Y^2 - (\Sigma Y)^2)}}$$

This won't be nearly as bad as it seems, because we've already found all the sums we need to substitute into the equation.

The thought of keying that equation into one line scares me; let's do it in pieces. Do the numerator first, call it NU; then do the two major terms in the denominator, calling them T1 and T2. Finally, we'll put it all together and find r .

```
320 NU = N*XY - SX*SY
330 T1 = N*X2 - SX*SX
340 T2 = N*Y2 - SY*SY
350 R = NU/SQR(T1*T2)
360 PRINT "CORRELATION COEFFICIENT (R) ="; R
```

When you run this with the example data, you'll find $r = .856481$, indicating a strong positive correlation.

The next program will do nonlinear regression. In other words, we'll be fitting curved lines to a set of data points.

Consider the following set of values:

X	Y
3	2
5	3
6	4
8	6
9	5
11	8

Once again, Y is the dependent variable. We'll again plot a scatter diagram, Fig. 3, to aid our visualization of the relation between X and Y. This time it isn't a straight line, but a parabola, or quadratic curve. The general

equation for a parabola is: $Y = a + bX + cX^2$. We'll calculate the values of the coefficients a , b , and c .

The coefficients a , b , and c can be found by solving the following set of simultaneous equations:

$$\begin{aligned}\Sigma X &= aN + b\Sigma X + c\Sigma X^2 \\ \Sigma XY &= a\Sigma X + b\Sigma X^2 + c\Sigma X^3 \\ \Sigma X^2Y &= a\Sigma X^2 + b\Sigma X^3 + c\Sigma X^4\end{aligned}$$

This time we need seven sums; name them and start coding the program. DIMension the X and Y vectors as we did before, use the trailer principle to read in the values, and initialize each of the sums to zero, if you like.

Sum in formulae	BASIC Variable Name
ΣX	SX
ΣX^2	X2
ΣX^3	X3
ΣX^4	X4
ΣXY	XY
ΣY	SY
ΣX^2Y	YX

```
10 DIM X(101), Y(101)
20 FOR I = 1 TO 101
30 READ X(I), Y(I)
40 DATA 3,2,5,3,6,4,8,6,9,5,11,8,-1,-1
50 IF X(I) < 0 THEN 70
60 NEXT I
70 N = I - 1
80 SX = 0
90 X2 = 0
100 X3 = 0
110 X4 = 0
120 XY = 0
130 SY = 0
140 YX = 0
150 FOR I = 1 TO N
160 SX = SX + X(I)
170 X2 = X2 + X(I)*X(I)
180 X3 = X3 + X(I)*X(I)*X(I)
190 X4 = X4 + X(I)*X(I)*X(I)*X(I)
200 XY = XY + X(I)*Y(I)
210 SY = SY + Y(I)
220 YX = YX + X(I)*Y(I)*Y(I)
230 NEXT I
```

I added a temporary PRINT statement to the program, 235 PRINT SX;X2;X3;X4;XY;SY;YX, and got the following values:

42 336 2940 27300 226 28 1994

You can check your keying to this point.

If we substitute these values

into the three simultaneous equations, we have:

$$\begin{aligned}28 &= a6 + b42 + c336 \\ 226 &= a42 + b336 + c2940 \\ 1994 &= a336 + b2940 + c27300\end{aligned}$$

Written in a more conventional form:

$$\begin{aligned}6a + 42b + 336c &= 28 \\ 42a + 336b + 2940c &= 226 \\ 336a + 2940b + 27300c &= 1994\end{aligned}$$

We'll now have to solve three simultaneous equations with three unknowns (a , b , c) using determinants. Determinants will seem complex at first, but the method will be easy to code, and will automatically produce answers.

Determinants

The determinant of a square matrix of order two is defined in Fig. 4. Find the product of the two numbers on the diagonal sloping down to the right, and then subtract the product of the two numbers on the other diagonal (Fig. 5). Try finding the solution to a determinant with some numerical values, as in Fig. 6. We have to solve determinants of order three, however, which is a matter of solving three determinants of order two, and multiplying (Fig. 7).

If we write down the coeffi-

$$\begin{vmatrix} x_{11} & x_{12} \\ x_{21} & x_{22} \end{vmatrix} = x_{11}x_{22} - x_{12}x_{21}$$

Fig. 4.

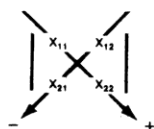


Fig. 5.

$$\begin{vmatrix} 5 & 8 \\ -2 & 4 \end{vmatrix} = (5 \cdot 4) - (8 \cdot -2) = 20 - (-16) = 36$$

Fig. 6.

Poor Man's Floppy

HIGH SPEED CASSETTE SYSTEM



Now the widely acclaimed JPC Cassette System is available for your TRS-80* computer. The price is only \$90.00

TC-8 Cassette System
JPC Products
Albuquerque, NM
Kit: \$90
Assembled: \$120

by Carl A. Kollar

I guess I don't have to tell any TRS-80 owners how frustrating the cassette system that comes with the computer can be. Even with the factory mod that's available, the annoyance of loading and checking programs becomes just barely tolerable.

If you're like me, after you've just plunked down a chunk of money for a Level II 16K machine, "you ain't got nuttin left" for even one disk drive at 500 bucks apiece. So you suffer.

A reasonable alternative is the Exatron Stringy Floppy (ESF). This will cost you about 250 bucks and totally eliminates your loading and saving problems, automatically and fast. I've had one of these for about six months and love it!

But, if the price is still too steep, have I got a device for you!

The Device

The February 1980 issue of *Microcomputing* had an ad that intrigued the hell out of me. It was a high-speed cassette system by JPC Products acclaimed as a "poor man's floppy." It made all sorts of seemingly ridiculous claims such as "loads five times faster," "stores 50,000 bytes on a 10-minute cassette," "less than one bad load in a million bytes with the volume control anywhere between one and eight."

All this for a measly [90] bucks? How could this be? A call to Albuquerque answered a few questions: Yes, it had its own power supply, and, it stored programs five times faster because it utilized higher density data. The computer outputs the information at a higher rate out of the rear keyboard connector.

The ad had even claimed anyone could build it even if you have never soldered before. JPC would make it work, if you couldn't—for free. I was sold. I placed my order, and it arrived about two months later (parts shortage).

I work in electronics, so I found the unit exceptionally easy to build. It took about an hour. The manual is superb. (That's better than great.) It was clear, concise and exact with no

[Reprint of June 1980 Review, *80 Microcomputing*]

ambiguities. Important parts placements are stressed (polarity markings on electrolytics, bands on diodes, etc.).

JPC was right! With these instructions, you couldn't go wrong. The board quality is excellent. It is double-sided and parts locations are clearly marked on the component side of the board. There are no jumper wires to install. JPC utilizes PC traces and plated-through holes for connections to traces on the other side of the board.

Also, there are absolutely no adjustments or settings to bother with.

The documentation is a sheaf of $8\frac{1}{2} \times 11$ papers stapled together. It is written in the nicest format I've seen in a while. Each command and/or subjects is covered on its own sheet in large type. All explanations are in easy to read English—not computerese.

Commands and Features

SAVE "filename": Saves your BASIC program on cassette.

LOAD: Reads the next BASIC program from the cassette.

LOAD "filename": Searches for and loads the specified file from cassette.

LOAD? and LOAD? "filename": Reads file from cassette, and compares contents to memory.

LOADN: Prints a list of all the programs on a cassette, until interrupted by the "break" key.

LOADN "filename": Same as above except the tape will stop at the end of the program named.

KILL: Removes the file manager program from memory so that the extra memory can be used by large programs.

RSET: Allows the operator to rewind and position the tape on tape recorders that have these functions tied to the motor control jack.

RUN "filename": TC-8 searches for a specified program and runs it immediately.

PUT "filename": Same as SAVE "filename", except it is for use with system tapes.

GET: Same as LOAD, except it is for use with system tapes.

GET "filename": Same as LOAD "filename", except it is for use with system tapes.

GET? and GET? "filename": Same as LOAD? and LOAD? "filename", except it is for use with system tapes.

GETN and GETN "filename": Same as

LOADN and LOADN "filename", except it is for use with system tapes.

OPEN: Required before cassette input or output of a data file can be attempted.

CLOSE: Required to end a cassette data file.

PRINT#: Allows numerical or string data to be output to a cassette file.

INPUT#: Allows numerical or string data to be input from a cassette file.

I haven't counted them, so I don't know about the "one load in a million bytes" claim, but my son, Anthony (age 11), loaded about 30 of his programs from his Radio Shack format tape to a new TC-8 format tape. He's run them all and found no bad loads.

Unlike the standard tape system, you can position your tape anywhere before the program you want and not have to look for a blank spot between programs. The TC-8 patiently waits for the program you want and then starts loading without getting confused by the portion of the previous program you just fed it.

Try that on your regular cassette system; you'll wear out the reset button. ■

ORDER NOW

To order your TC-8 kit, send your check or money order for \$90.00 plus \$3.50 postage and handling to JPC PRODUCTS CO., 12021 Paisano Ct., Albuquerque, NM 87112 (New Mexico residents add 4% sales tax). Credit card orders accepted by phone or mail. Personal checks will delay shipment. We will otherwise immediately ship you the TC-8 kit, the cabinet, the ribbon cable, the power adapter, an instruction manual, and a cassette containing the software.



JPC PRODUCTS CO.
Phone (505) 294-4623
12021 Paisano Ct.
Albuquerque, N.M. 87112

$$\begin{vmatrix} X_{11} & X_{12} & X_{13} \\ X_{21} & X_{22} & X_{23} \\ X_{31} & X_{32} & X_{33} \end{vmatrix} =$$

$$X_{11} \cdot \begin{vmatrix} X_{22} & X_{23} \\ X_{32} & X_{33} \end{vmatrix} - X_{12} \cdot \begin{vmatrix} X_{21} & X_{23} \\ X_{31} & X_{33} \end{vmatrix} + X_{13} \cdot \begin{vmatrix} X_{21} & X_{22} \\ X_{31} & X_{32} \end{vmatrix}$$

Fig. 7.

cients of a, b, and c from our three simultaneous equations in determinant form, we have Fig. 8.

I've made a column vector of the three values to the right of the equals signs in the equations, to the right of my 3 x 3 matrix, just for reference.

Here's the trick: the 3 x 3 matrix is going to become the denominator in three division operations, each of which will find a, b, or c. The three numerators will be formed by substituting the column vector to the right for each of the three columns of the 3 x 3 matrix, in turn. In other words, we calculate as shown in Fig. 9.

On the left are the values for the example we're working with, and on the right are the variable names for the general case. The six 3 x 3 matrices on the right are the ones we'll code a program to solve. Each of the six will be solved using the general method for a 3 x 3 determinant.

The denominators are all the

same, so let's begin by writing the code to find the determinant of the denominator:

```
240 D1 = X2 * X4 - X3 * X3
250 D2 = SX * X4 - X3 * X2
260 D3 = SX * X3 - X2 * X2
270 D = (N * D1) - (SX * D2) + (X2 * D3)
```

If you want to check your progress, put in the temporary PRINT statement 275 PRINT D, and you should get a value of 63504.

Now write the code for calculating the other three determinant values, and solve for a, b, and c, using the same methods we used for the denominator.

```
280 A1 = X2 * X4 - X3 * X3
290 A2 = XY * X4 - X3 * YX
300 A3 = XY * X3 - X2 * YX
310 A = ((SY * A1) - (SX * A2) + (X2 * A3)) / D
320 B1 = XY * X4 - X3 * YX
330 B2 = SX * X4 - X3 * X2
340 B3 = SX * YX - XY * X2
350 B = ((N * B1) - (SY * B2) + (X2 * B3)) / D
360 C1 = X2 * YX - XY * X3
370 C2 = SX * YX - XY * X2
380 C3 = SX * X3 - X2 * X2
390 C = ((N * C1) - (SX * C2) + (SY * C3)) / D
400 PRINT
410 PRINT "A = "; A
420 PRINT "B = "; B
430 PRINT "C = "; C
```

$$a = \frac{\begin{vmatrix} 28 & 42 & 336 \\ 226 & 336 & 2940 \\ 1994 & 2940 & 27300 \end{vmatrix}}{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}} = \frac{\begin{vmatrix} SY & SX & X2 \\ XY & X2 & X3 \\ YX & X3 & X4 \end{vmatrix}}{\begin{vmatrix} N & SX & X2 \\ SX & X2 & X3 \\ X2 & X3 & X4 \end{vmatrix}}$$

$$b = \frac{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}}{\begin{vmatrix} 6 & 42 & 28 \\ 42 & 336 & 226 \\ 336 & 2940 & 1994 \end{vmatrix}} = \frac{\begin{vmatrix} N & SX & X2 \\ SX & X2 & X3 \\ X2 & X3 & X4 \end{vmatrix}}{\begin{vmatrix} N & SX & SY \\ SX & X2 & XY \\ X2 & X3 & YX \end{vmatrix}}$$

$$c = \frac{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}}{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}} = \frac{\begin{vmatrix} N & SX & X2 \\ SX & X2 & X3 \\ X2 & X3 & X4 \end{vmatrix}}{\begin{vmatrix} N & SX & X2 \\ SX & X2 & X3 \\ X2 & X3 & X4 \end{vmatrix}}$$

Fig. 9.

```
440 PRINT
450 PRINT "BEST FITTING PARABOLA:"
460 PRINT
470 PRINT "Y = "; A; " + "; B; " * X + "; C; " *
    X^2"
480 PRINT
490 END
```

Key this in, adding it to the first part of the program, run it, and you should get:

```
A = .666667
B = .380952
C = .0238095
```

The equation for the best fitting parabola, therefore, is:

$Y = 0.666667 + 0.380952X + 0.0238095X^2$

You can use this equation for

$$\frac{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}}{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}} = \frac{\begin{vmatrix} 28 \\ 226 \\ 1994 \end{vmatrix}}{\begin{vmatrix} 6 & 42 & 336 \\ 42 & 336 & 2940 \\ 336 & 2940 & 27300 \end{vmatrix}}$$

Fig. 8.

making predictions of Y after keying in X values, just as we did with the linear regression model. Check lines 260 through 310 in the previous program. Lines 260, 270, and 280 should be the same. Line 290 would become: $YY = A + B * XX + C * XX^2$ and lines 300 and 310 would be the same. Of course, you'd have to adjust the various line numbers to correspond to the later placement in the program. ■

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"THE TIME IS 4 HOURS 23 MINUTES . . . (BEEP)"
"NUMBER 4 IS 3.47 VOLTS"

"THE SPEED IS 100 METERS A SECOND . . . SLOW DOWN"

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Woodmere, NY 11598
Dealer inquiries invited.



It does just that!

The Variable Lister

John L. Webster
9606 Todd Mill
Huntsville, AL 35803

On several occasions, I have wished that my TRS-80 would list out the variables used in a program. This would help in documenting software and selecting variables during the development of a new program. After waiting a few months for someone else to publish an answer to my wish, I gave in and worked out my own solution. Surprisingly, it was easier than anticipated.

PEEKing at the storage area after entering a variety of variables led to the discovery that a numerical flag such as two, three, four, or eight is used to signal which type of variable follows. A flag two signifies an integer variable, a three indicates a string variable, a four indicates single precision (unspecified TRS-80 variables fall into this category by default), and an eight signals a double precision variable.

The next character in sequence is the ASCII value for the subscript or second portion of the variable name. The third character is the ASCII value of

the first portion of the variable name.

The contents of addresses 40F9 and 40FA (16633 and 16634) give the starting address for the variable storage areas.

My Variable Lister program begins by PEEKing at 16633 and 16634 then goes to the indicated memory area and PEEKs and tests for the numerical flags two, three, four, or eight. I used odd-ball variable names (ZV through ZY) in the Variable Lister program so that it would not make use of variable names normally found. Line 10015 in the program tests for the first of these odd-balls, "ZV", and tells us when the searching of variables has reached the searching program's own storage area. At that point we branch to line 10070 and print out the results of the variables found.

Using Variable Lister requires that it be entered at the end of the program whose variables are to be searched out and listed. Since it is only an 18-line routine, this might be tolerable; however, it can also be merged with any program using smaller line numbers. As an experiment I merged the Variable Lister with Radio Shack's Backgammon demo program using the follow-

ing procedure:

- Enter and CSAVE the Variable Lister on cassette.
- CLOAD the program whose variables are to be found and listed.
- Do a PRINT PEEK(16633),PEEK(16634). Write down the results.
- If PEEK(16633) was equal to or greater than two go to step six.
- POKE 16548,PEEK(16633)+254:POKE 16549,PEEK(16634)-1 go to step seven.
- POKE 16548,PEEK(16633)-2:POKE 16549,PEEK(16634)
- CLOAD the Variable Lister.
- POKE 16548,233:POKE 16549,66
- Run the program. (This is an important step!)
- Break and then GOTO 10000.

I have observed that when the Variable Lister is appended to a target program, the target program must be run before the GOTO 10000. Otherwise, the variables are not found.

To those of you who have been waiting for someone else to publish a variable listing procedure, I hope that this simple program will satisfy your wish. It doesn't do the array variable but they are usually flagged by their DIM statement. ■

```
5000 REM *** INSTRUCTIONS ***
5010 CLS:PRINTTAB(10);"VARIABLE-LISTER INSTRUCTIONS"
5020 PRINT:PRINT"THIS PROGRAM MUST BE APPENDED TO THE TARGET PROGRAM"
5030 PRINT"BY THE FOLLOWING METHOD:"
5040 PRINT"(1) CLOAD THE TARGET PROGRAM."
5050 PRINT"(2) PRINTPEEK(16633),PEEK(16634) WRITE DOWN RESULTS."

5060 PRINT"(3) IF PEEK(16633)=>2 THEN SKIP STEP 4 AND DO STEP 5."
5070 PRINT"(4) POKE16548,PEEK(16633)+254:POKE16549,PEEK(16634)-1"
5075 PRINT"JUMP TO STEP 6."
5080 PRINT"(5) POKE16548,PEEK(16633)-2:POKE16549,PEEK(16634)"
5090 PRINT"(6) CLOAD VARIABLE LISTER PROGRAM"
5100 PRINT"(7) POKE16548,233:POKE16549,66"
5110 PRINT"(8) RUN THE TARGET PROGRAM! ( THIS IS ESSENTIAL! )."
5120 PRINT"(9) 'BREAK' AND 'GOTO10000' TO EXECUTE LISTER."
5150 END
10000 REM *** VARIABLE LISTER ***
10005 ZV=PEEK(16633)+256*PEEK(16634)
10010 ZW=PEEK(ZV):ZX=PEEK(ZV+1):ZY=PEEK(ZV+2)
10015 IF ZV=90 AND ZX=86 THEN 10070
10020 LPRINT CHR$(ZY);CHR$(ZX);
10030 IF ZW=2 THEN 10080
10040 IF ZW=3 THEN 10090
10050 IF ZW=4 THEN 10100
10060 IF ZW=8 THEN 10110
10070 LPRINT:LPRINT"VARIABLE SEARCH ENDED":STOP
10080 LPRINT" % INTEGER":ZV=ZV+5:GOTO10010
10090 LPRINT" % ",PEEK(ZV+3);" CHAR. LONG":ZV=ZV+6:GOTO10010
10100 LPRINT" ! SINGLE PRECISION":ZV=ZV+7:GOTO10010
10110 LPRINT" # DOUBLE PRECISION":ZV=ZV+11:GOTO10010
10200 PRINT"ARRAY VARIABLES ARE NOT INCLUDED":END
```

Program Listing



ADVENTURE INTERNATIONAL



NEW

StarFighter

On any LANDBASE CENTRAL - in any part of the known universe - on any morning - a very meaty looking craft can be seen standing with its control console visible: waiting. If one watches for a while, a figure in unique garb will approach the console of his Combat Computer, insert his pilot record and begin yet another journey into the deep dark reaches of space...

The SC-78503 STARFIGHTER craft is the most sophisticated ship known to man. You, as its pilot, are instructed that the current state of relations with the Petro Resource Conglomerate is a state of war. As such, you are charged with ridding the galaxy of dreaded P.R.C. craft, to insure life as we know it in the Solar Galactic Authority.

A STARFIGHTER tour of duty lasts anywhere from twenty minutes to six hours. You must track down, and identify craft. LANDBASE CENTRAL frowns on destruction of friendly craft. Identification is critical - STAR PIRATES and MARAUDERS frequently disguise themselves as friendly craft. Only by monitoring their movements and learning their habits can you hope to survive. Once identified as a foe, the dogfight can begin.

You start out as a NEW PILOT, hoping after many hours of play to reach the coveted rank of STAR LORD. (As a NEW PILOT, you also have access to the enclosed SC-78503 Training Simulator, which can help you to hone your identifying and fighting abilities.) Destruction of enemy craft can be used for consideration for promotion, or in trade for bounty necessary to keep you in Hypercharge and Maneuvering fuel. Your SC-78503 STARFIGHTER induction package includes two cassette tapes (one for Main Mission - one for the SC-78503 Simulator) or one self-booting disk. Also included is the top secret STARFIGHTER induction manual - 32 pages in length, which will guide you step by step through your initiation into this fascinating new world.

... The pilot leaving duty will head for LANDBASE CENTRAL to tally and clear his craft hit record. Review complete, he inserts his record tape (or disk) and records his precious Action File. File in hand, he steps out of his craft - glad for earth between his feet - but anxious for his next chance at STARFIGHTER duty. Meanwhile, the SC-78503 sits - waiting for some VETERAN or NEW PILOT to slide behind its console and sift stars for the denizens of the P.R.C. ...



STARFIGHTER by SPARKY STARKS

010-0120 TAPE.....\$24.95

TRS-80 Model I/III and PMC-80 16K & up

012-0120 DISK.....\$29.95

Trs-80 Model I — 32K and up

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COMMBAT

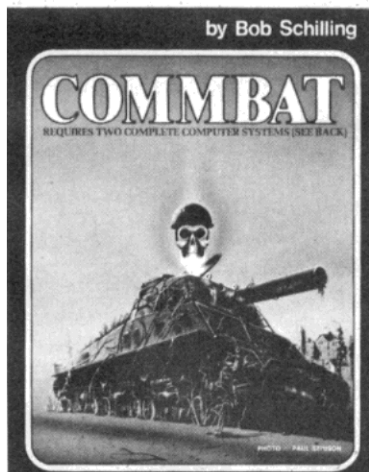
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Offensive and defensive weapons available to you include: Rockets, Lasers, Shells, Mines, Decoys, Drone Reconnaissance Aircraft and one Nuclear ICBM. All but the last two items may be loaded onto, carried by and fired or dropped by your tanks, up to their maximum load carrying capacity.

Your computer displays current resource status, a map of the combat reservation updated by tank, base and decoy sensors and handles all communication chores, freeing you to make the strategic decisions and prosecute the tactical battle situations that arise.

COMMBAT requires as a minimum a computer system with RS-232 port and a 300 baud full duplex modem, or if the combatants are to be located within 300 feet of each other, a modem eliminator cable in lieu of the modems.



by Bob Schilling

COMMBAT by ROBERT SCHILLING

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A Model 33, a Multi-80 and a dash of software.

Recipe for Hard Copy

Larry Keith
3903 Marsha Drive
Columbus, OH 43207

Do you have a Level II TRS-80 and dream of hard copy capability? If you have \$2000, your local Radio Shack store has an expansion interface and a line printer. However, \$2000 is more than most of us can handle, but take heart—I have a recipe you'll like.

Take one used teletype machine, add one interface device, combine with a printer driver program, and season with a couple hours work. The result: Instant hard copy with minimum expenditure.

So you don't know anything about teletype machines and you've never seen a printer interface device that doesn't require an expansion interface. What does a driver program look like? I will describe each element of the system, provide sources for each and give you some first-hand advice on how to create the cheap and painless print system.

Ingredients

The teletype machine, or more correctly, the teleprinter set, is an electro-mechanical device originally designed for communications use, either in a land

line or radio circuit. After ASCII (American Standard Code for Information Interchange) was developed, teleprinters using that code became popular. There are still a lot of non-ASCII machines floating around—stay away from them. We do not need the aggravation of adding an ASCII to baudot converter to our system.

There are several manufacturers of teleprinters: Kleinschmidt, Mite, Lorenz, ITT Creed and Teletype Corporation. Teletype Corporation of Skokie, IL, is the predominant manufacturer and your best bet for a used machine. I will confine my discussion to the Teletype brand.

During my research, I found references to Models 11, 12, 14, 15, 19, 20, 26, 28, 29, 31, 32, 33, 35, 37, 38, 40 and 43. Models 33, 35 or 43 use ASCII and are still in service throughout the country. Consequently, repair service is available and parts and supplies are easily obtained.

Let's look at one popular model, the Teletype Model 33. The Model 33 can be found in three distinct configurations: receive only (RO); keyboard send-receive (KSR); and automatic send-receive (ASR).

The RO set can only receive and print messages. The KSR set can originate messages as well as receive and print. The ASR set transmits, receives,

prints and has the capability to automatically initiate, accept and control incoming messages.

There are also variations within the three configurations. Some machines are friction feed and some use sprocket form feed. You may find a unit with a tape punch and a tape reader. All use ASCII, print on 8½-inch paper, print 72 characters per line and 10 lines to the inch at 110 baud (100 wpm), and are ideal line printers for hobby computer applications.

These machines are advertised for around \$300. Concentrate on the receive only (RO) machines; they cannot be used as terminals, so the price is us-

ually lower. And don't overlook some of the oddball machines, as long as they will print the whole character set. Such machines are often ideal for this application. Hamfests are also a good place to find teletype equipment, since a lot of hams use them for radio-teletype applications.

Sources

The following are some sources to investigate. (I cannot personally recommend these companies since I have not done business with them.)

• Typetronics
Box 8873
Ft. Lauderdale, FL 33310



Photo 1.

- General Peripherals
68 B Merrimac St.
Danbury, CT 06810
- D. Lavers
Suite 719, 5217 Morris St.
Halifax, NS, Canada B3J 1B7
- Lawrence R. Pfleger, K9WJB
2600 South 14th St.
St. Cloud, MN 56301

You also need an interface from your TRS-80 to the teleprinter. Several magazine construction articles describe such an interface. (Dig out those old copies of *Kilobaud* and take a look.) There are also ready-made interface devices available. The following are some sources:

- Small System Software
P.O. Box 366
Newbury Park, CA 91320
- Hobby World
19511 Business Center Drive
Northridge, CA 91324
- Salvage 2
1358 Byron Avenue
Columbus, OH 43227

Finally, you must have a program to drive the teleprinter. Salvage 2 and Small System Software furnish printer-driver programs with their interface devices. Other driver programs have been published.

A Printer Subsystem

I use a Model 33 Teletype machine. I purchased a Multi-80 from Salvage 2. The Multi-80 (\$49.95) is an interface device with some additional features. I also purchased the TRS-232 Formatter program from Small System Software (\$14.95). The total cost of my printer subsystem was less than \$275.

The Multi-80 is a multiple purpose TRS-80 accessory developed and produced by Salvage 2. Check the following features:

- A solid state Teletype interface that uses cassette output to feed the Teletype machine—no expansion interface required.

- A cassette relay protection circuit that uses internal TRS-80 cassette motor relay to switch to a heavy-duty relay in the Multi-80.

- A cassette control circuit that allows you to gain control of the cassette recorder by simply flipping a switch. Fast-forward, rewind, and all other cassette motor controls are available without unplugging the subminiature plug or resorting to software control.

- Audio output is available from a rear panel jack on the Multi-80 for monitoring the CLOAD and CSAVE functions and for using that output for sound effects in user programs.

The Multi-80 runs from 117 V ac. The unit comes with instructions, a printer-driver program on cassette, and a one-year limited guarantee.

The unit is packaged in a neat gray and black box that measures 3 x 5 x 6 inches. Connections are via jacks located on the rear panel. Two switch controls and an LED are mounted on the front panel.

Installation and Operation

Three interconnecting cables run from the Multi-80 to the cassette recorder, and one cable runs from the Multi-80 to the Teletype machine. Two cables must be terminated on each end with miniature plugs and one cable must be terminated on each end with a subminiature plug. I used Radio Shack 72-inch shielded cables. The Teletype to Multi-80 cable is Radio Shack

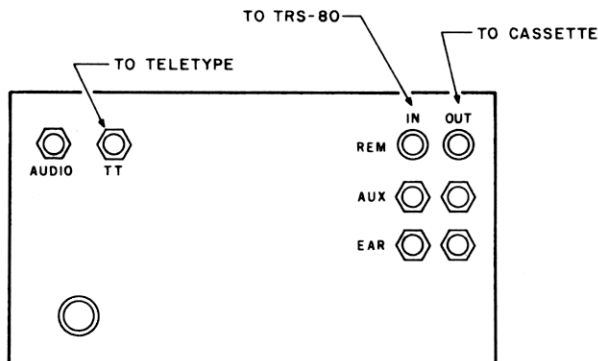
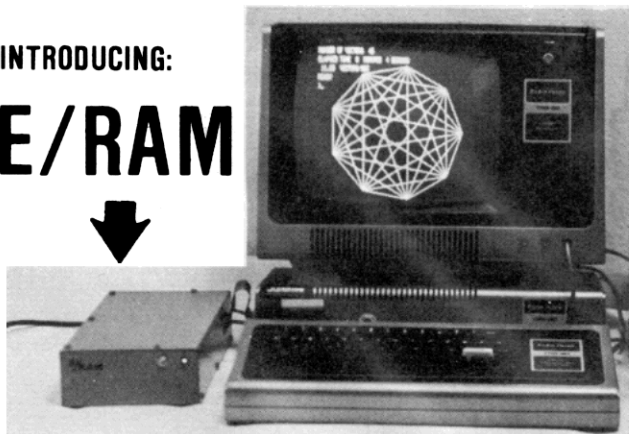


Fig. 1. Multi-80 Connections

HI-RESOLUTION GRAPHICS FOR TRS-80*

INTRODUCING:

E/RAM



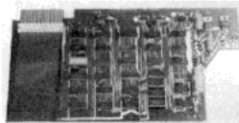
E/RAM Graphics is a unique hardware/software package, which will integrate high-speed, high resolution graphics into any Level II TRS-80 system. E/RAM hardware is a fully plug-compatible box, which installs in minutes, and requires absolutely no modifications to the TRS-80 system. E/RAM software is a compact, relocatable set of utilities which provides the user with easily accessible graphics functions. For instance: the user pokes the end point coordinates of a line into certain locations, does a USR call, and an optimized dot-raster line is automatically drawn on the screen at very high speed (less than 10 milli-seconds for a medium length line).

E/RAM does not require the purchase of an additional monitor CRT. The high-resolution graphics video is synchronized with the TRS-80 video and appears on the screen with the normal TRS-80 display. Alphanumeric, TRS-80 graphics, and E/RAM high-resolution graphics may be displayed simultaneously or individually.

E/RAM hardware contains its own 6144 byte video memory, which provides a true 256 x 192 matrix of independent graphic elements. (E/RAM is NOT a programmable character generator type graphics system. Character generator systems have serious limitations in full screen graphics applications.)

E/RAM will operate with or without an expansion interface, and with any standard memory configuration (4k through 48k).

E/RAM is fast. "E/RAM" is an acronym for Extended Random Access Memory, a very short description of the Patent-Pending method of I/O employed by this device, which gives it memory-mapped speed without interfering with the memory space used by the TRS-80.



The installation of E/RAM will not affect normal operation of the TRS-80. High resolution ON/OFF is under program or manual control (a switch is provided). An expansion card edge connector is provided so that other peripherals may be used on the TRS-80 bus.

E/RAM software package is compact (less than 1000 bytes), fast, easy to use, and very flexible. A relocating loader is provided. The user can delete unneeded routines if more memory space is required. Lines can be drawn as fast as 13 per second using BASIC USR calls, and as fast as 200 per second using assembly language programs.

Routines usable through USR of BASIC, and of course an assembler CALL are:

INIT	- Sets up display
PLOT	- Plots a point
READ	- Reads a point from the screen
BLACK	- Sets drawing mode to black (off)
WHITE	- Sets drawing mode to on
CLEAR	- Clears the high-resolution graphics screen
LINE	- Draws a line

As an example, after the utilities package is loaded and you desire to draw a line, the following sequence of BASIC instructions could be executed:

```

U=USR(0)      Return the communications area
POKE U+1,X0   Provide the beginning X coordinate
POKE U+3,Y0   Provide the beginning Y coordinate
POKE U+5,X1   Provide the ending X coordinate
POKE U+7,Y1   Provide the ending Y coordinate
V=USR(4)      Draw the line (Current speed is
               approximately 13 vectors/second)
  
```

The complete E/RAM package is available for only \$349.95, and includes case, power supply, cables, software cassette, and complete documentation.

To order, or for further details, write or call.

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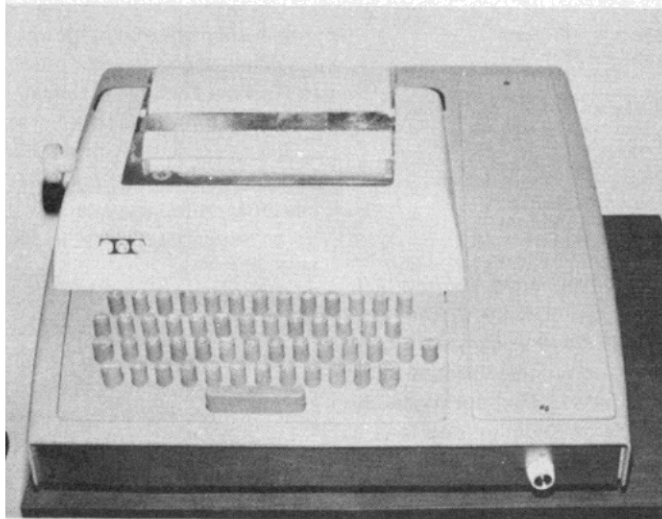


Photo 2.

number 22 speaker wire.

Installation is simple. I removed the cassette plugs from the recorder and plugged them into the corresponding input jacks on the rear of the Multi-80. I connected the output jacks on the Multi-80 to the cassette recorder using the 72-inch cables. The jacks are clearly marked, and by connecting both ends of each cable before I started on the next one, I avoided getting my wires crossed. After connecting the Teletype to the Multi-80 via the output jack marked TT, I plugged the line cord into the last available wall outlet in my computer room (see Fig. 1).

Multi-80 operation is not complex. The switch marked PR and CA controls the printer/cassette

signal. This switch can be left in the PR (printer) position except when CSAVEing a program. Then flip the switch to CA (cassette auxiliary) until the CSAVE is complete. The red LED on the panel lights up whenever the recorder relay is activated.

The TRS-232 Formatter

The TRS-232 Formatter program is a new advanced printer software package from Small System Software. This versatile BASIC program is exactly what you need to produce professional hardcopy. Features include:

- Printer paging allows you to set the number of lines for your paper and the number of lines that you wish printed on each page.

- Line length control causes



Photo 3.

MULTI-USER OASIS HAS THE FEATURES PROS DEMAND. READ WHY.

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The biggest challenge for any multi-user system is co-ordinating requests from several users to change the same record at the same time.

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OASIS has automatic record locking features to solve these problems.

For example: normally all users can view a particular record at the same time. But, if that record is being updated by one user, automatic record locking will deny all other users access to the record until the up-date is completed. So records are always accurate, up-to-date and integrity is assured.

Pros demand file & automatic record locking. OASIS has it.

SYSTEM SECURITY: LOGON, PASSWORD & USER ACCOUNTING

Controlling who gets on your system and what they do once they're on it is the essence of system security.

(THEN COMPARE.)

Without this control, unauthorized users could access your programs and data and do what they like. A frightening prospect isn't it?

And multi-users can multiply the problem.

But with the Logon, Password and Privileged Level features of Multi-User OASIS, a system manager can specify for each user which programs and files must be accessed—and for what purpose.

Security is further enhanced by User Accounting—a feature that lets you keep history of which user has been logged on, when and for how long.

Pros insist on these security features. OASIS has them.

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A multi-user system is often not even practical on computers limited to 64K memory.

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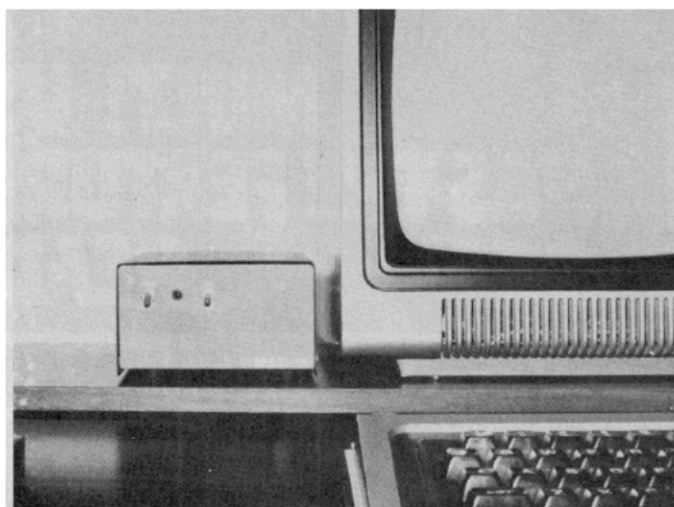


Photo 4.

the program to execute an automatic carriage return when a selected number of characters is reached.

• Smart line termination is the feature I like best. After a selected number of characters, which must be less than the line length control, is reached, the program looks for a space, colon, semi-colon or comma. If one is found, the program executes an early carriage return. This feature minimizes word division and enhances readability.

• Line indentation is an automatic feature. If a line is continued, the program advances five spaces before it continues printing.

• Print all screen output is an option that allows all Print statements to be directed to the printer. This option can be input via

the keyboard or embedded in your program.

• Simultaneous screen display directs print to both the printer and the video display.

• Printer pause can be used to stop the printer at the end of a line by hitting the space bar. Each successive input of space bar will cause one more line to print. Hitting any other key continues normal printer operation.

• Keyboard debounce is included and loads with Formatter; it can be disabled.

• Multiple baud rates of 110, 134.5, 150, 300, 450, 600, 1200, 2400, 4800, or 9600 may be selected during program initialization. Page six of the instruction booklet supplies modification to allow for non-standard baud rates.

• Line feeds and form feeds

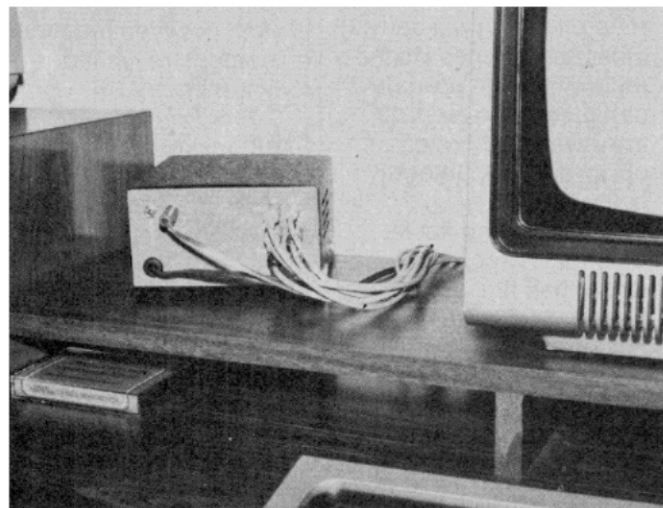


Photo 5.



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- **CONVERT OFFICE SELECTRIC TO I/O TYPEWRITER** — Kit includes assembled solenoids, switches, wire harness, magnet driver PCB plus instructions for installation and mCPU interface. Price \$150.00
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PACIFIC OFFICE SYSTEMS ✓153

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are available; if your printer will not accept a form feed character, this program will use multiple line feeds to make up for that deficiency.

• Documentation is excellent. The 17-page instruction booklet includes complete instructions in clear, readable English for BASIC programs, assembly language listings and instructions for customizing the program.

The Formatter is a BASIC program that POKes language instructions into a protected high memory area. The program requires 360 bytes at the top of memory. The instruction booklet suggests answering the memory size question with the value 32400.

Running the program for the first time, the following questions must be answered. Hitting the enter key in lieu of answering the questions assigns default values.

QUESTION	DEFAULT VALUE
ENTER INITIALIZATION MEMORY SIZE?	32400
SELECT BAUD RATE?	300
ADD LINE FEED AFTER CARRIAGE RETURN (Y/N)?	Y
DOES YOUR PRINTER RECOGNIZE FORM FEEDS (Y/N)?	Y
MAXIMUM ALLOWED PRINTER LINE LENGTH (25-250)	80
LINE LENGTH FOR EARLY LINE TERMINATION (20-250)?	70
NUMBER OF NULLS (0-120)?	0
TOTAL NUMBER OF LINES PER PAGE (0-120)?	66
NUMBER OF LINES TO PRINT ON EACH PAGE (0-120)?	58
ECHO PRINTER TO SCREEN (Y/N)?	Y
ARE YOU USING DISK BASIC (Y/N)?	Y
DO YOU WANT KEYBOARD DEBOUNCE (Y/N)?	Y

For my Model 33, I used the values shown below:

QUESTION	DEFAULT VALUE
ENTER INITIALIZATION MEMORY SIZE?	32400
SELECT BAUD RATE?	110
ADD LINE FEED AFTER CARRIAGE RETURN (Y/N)?	Y
DOES YOUR PRINTER RECOGNIZE FORM FEEDS (Y/N)?	N
MAXIMUM ALLOWED PRINTER LINE LENGTH (25-250)	72
LINE LENGTH FOR EARLY LINE TERMINATION (20-250)?	62
NUMBER OF NULLS (0-120)?	2
TOTAL NUMBER OF LINES PER PAGE (0-120)?	66
NUMBER OF LINES TO PRINT ON EACH PAGE (0-120)?	56

ECHO PRINTER TO SCREEN (Y/N)?
ARE YOU USING DISK BASIC (Y/N)?
DO YOU WANT KEYBOARD DEBOUNCE (Y/N)?

Y
N
Y

The answers describe the characteristics of my Model 33 teleprinter and my TRS-80 Level II 16K system. Setting the early line termination as 62 assures very few continued lines will have any divided words. Fifty-six lines of print gives me about 5/8 of an inch margin at the top and bottom of the page.

Twelve program lines within Formatter control the options. I customized the program for my printer, changing the variables, and deleting the input statements and all REM statements. My customized Formatter loads faster, since about half the original program lines were REM statements.

Three special keyboard commands are recognized by Formatter, and may also be used within a program. The commands are:

- LPRINT CHR\$(1)— Sets the print all screen output option.
- LPRINT CHR\$(2)— Clears the print all screen output option.
- LPRINT CHR\$(3)— Reinitializes the Formatter line counter to prevent erroneous form feed after a partial page has been printed. (The line counter does not automatically clear when a partial page is printed.) If you are using the keyboard debounce routine, you can use the clear key to reset the line counter, also.

Day to day operation is a snap. I always need the debounce routine. I am in the middle of a major project, documenting all my programs via the printer. I will soon be able to throw away all those annotated code sheets and use only my notebook of printer-produced listings. I will soon have a paper index of all my programs, an index of my Level II manual, a real tape log, and an index of my computer magazines. None of these would be possible without my printer. ■



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By Sparky Starks from Adventure Int.
As mercenary and galactic police officer, you must maintain the condition and control of all parts of your spacecraft. You sit at the controls while peering out of the digital space-view port. Suddenly something appears on your screen: is it a Starfighter or a friendly merchant ship? You can't tell yet, and at this speed you may have only a fraction of a second to make an attack/no attack decision.

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From Instant Software
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TRS-80 Level II 16K

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Honestly...

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However, most computer stores are ignoring TRS-80 owners, and they do not carry peripherals for TRS-80. Because of this situation, we have decided to occasionally advertise hardware for the TRS-80 that we feel is of exceptional merit.

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80 Microcomputing, May 1981, p. 30.

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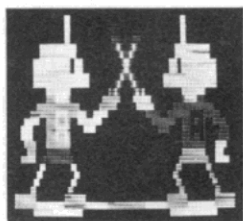
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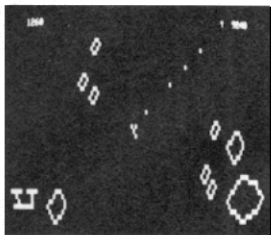
From Sub-Logic

The wait is over! If 3-D graphics seem impossible on the low resolution TRS-80, you haven't seen this brilliant program. During FLIGHT SIMULATION, you instantly select instrument flight, radar, or a breathtaking pilot's-eye-view. But be sure to strap yourself in -- you're liable to get dizzy!

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TRS-80 Level II 16K
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SUPER NOVA

By Bill Hague from Big Five
Asteroids surround your ship. You must shoot the asteroids, as well as any alien spaceships. Written in fast machine code, this game is GREAT!

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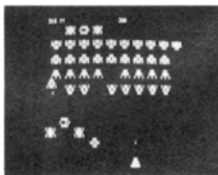
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SPACE WAR

By Device Oriented Games from Acorn
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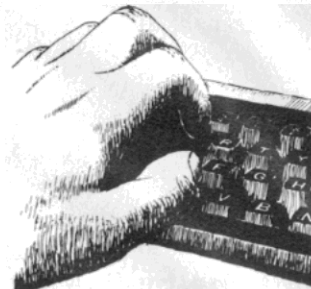
PINBALL

By John Allen from Acorn
Get your flipper fingers ready for action in this real-time, machine language game.

Lots of sound and flashing graphics make this fast action game so much like the real thing that you'll have to remind yourself not to shake your TRS-80. Choose from five playing speeds to match your skill. Can you beat your friends' scores? Will you avoid the dreaded "Bermuda Square?" Get PINBALL today and find out.

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By Ainsworth & Baker from Microsoft
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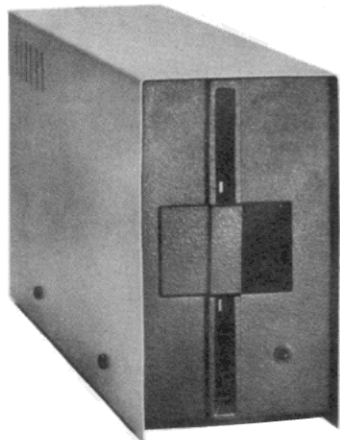
Choose the game speed, enemy bomb frequency and accuracy, shots on screen and the number of your bases. Move your base and simultaneously fire at the invaders -- you cannot do this in most similar games. Full sound effects add even more excitement to the incredible speed and action of INVADERS FROM SPACE. Fun for all ages and skill levels.

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About our warranty

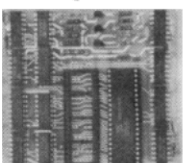
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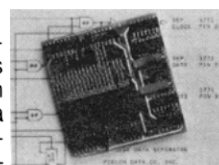


Percom's new plug-in adapter for your Expansion Interface stores almost twice the data on a diskette track as a single-density system. You can store up to four times more data — depending on the type of drive — on one side of a diskette than you can store using a standard Model I mini-disk drive. Other features: Reads, writes and formats either single or double density minidiskettes. • Runs TRSDOS*, NEWDOS+† Percom OS-80™ or other single-density software without changing either software or hardware. Switch to double-density when convenient. • Includes DBLDOS™, a TRSDOS* compatible double-density operating system. • Includes on card, high-performance data separator circuit. • Installs without rewiring or trace cutting. • Introductory price, including DBLDOS and format conversion utility, only \$219.95.

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How to Handle Those Random Files

Random files are easy to use; easier, in fact, than sequential files with their involved punctuation requirements. One disadvantage of random files is wasted space if your records are less than 255 bytes. We'll dis-

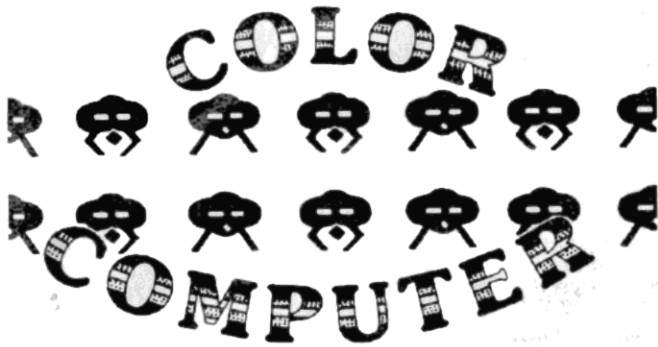
To convert the single precision number stored in variable P to a four-byte string, use `P$ = MKS$(P)`. Use `Q$ = MKI$(Q)` to convert the integer in variable Q to a two-byte string. To get the

You can use any variable names and sizes you desire. If you run your letters together

I have always found it safest to GET a record before you PUT it, even if it doesn't exist yet. Funny things sometimes hap-

[illegible]

80 Microcomputing, July 1981 • 271



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pen if you don't. Note that this can't be done with a Model II.

Program Listing 1 is a sample program to enter some inventory items. Assume the file has been opened already. The LOF(1)+1 in line 100 sets X to the next available record. LOF(1) is the last record (Last Of File).

Program Listing 2 enables us to read records. Again assume the file is already open.

Program Listing 3 enables us to change one item in the inventory.

Techniques

In a few cases I used LINEINPUT, when the data might contain a comma or other delimiter which would get an Extra Ignored if I used INPUT. When I asked for ANOTHER, I only

looked at the first letter in the reply. That way Y or Yes or Yeah, etc. would work.

When printing the price, I used PRINTUSING to give a properly formatted display. In lines 580 to 620 I set the variable to the old value before using INPUT. This meant the old data would be in the variable if the user replied only Enter. This doesn't work in the lines that use LINEINPUT.

GOTO 30 is at the end of every module. Program Listing 4 explains that.

Put the four program segments together and you have a complete program. This is an example of modular programming.

Problems

The program wastes a lot of

```
100 X=LOF(1)+1
110 LINEINPUT"ITEM DESCRIPTION? ";IS
120 INPUT"QUANTITY";Q
130 INPUT"PRICE";P
140 LINEINPUT"LOCATION? ";LS
150 INPUT"DATE (M1/02/88)";DAS
160 FIELD 1, 25 AS AS, 2 AS BS, 4 AS CS, 10 AS DS, 8 AS ES
170 GET 1,X
180 LSET AS=IS:LSET AS=MKIS(Q):LSET CS=MKSS(P)
190 LSET DS=LS:LSET ES=DAS
200 PUT 1,X:X=X+1
210 INPUT"ANOTHER";ANS:IF LEFT$(ANS,1)="Y" THEN 110
220 GOTO 30
```

Program Listing 1

```
300 LINEINPUT"ITEM DESCRIPTION? ";IS
310 FOR X=1 TO LOF(1)
320 FIELD 1, 25 AS AS, 2 AS BS, 4 AS CS, 10 AS DS, 8 AS ES
330 GET 1,X
340 IF INSTR(AS,IS)>0 THEN 360
350 NEXT X:PRINT"ITEM NOT FOUND":GOTO 410
360 PRINT"ITEM DESCRIPTION: ";AS
370 PRINT"QUANTITY: ";CVI(BS)
380 PRINTUSING"PRICE: $$$###.##";CVS(CS)
390 PRINT"LOCATION: ";DS
400 PRINT"DATE: ";ES:PRINT
410 INPUT"ANOTHER";ANS:IF LEFT$(ANS,1)="Y" THEN 300
420 GOTO 30
```

Program Listing 2

```
500 LINEINPUT"ITEM DESCRIPTION? ";IS
510 FOR X=1 TO LOF(1)
520 FIELD 1, 25 AS AS, 2 AS BS, 4 AS CS, 10 AS DS, 8 AS ES
530 GET 1,X
540 IF INSTR(AS,IS)>0 THEN 560
550 NEXT X:PRINT"ITEM NOT FOUND":GOTO 660
560 PRINT"REPLY WITH <ENTER> IF YOU DO NOT WISH TO"
570 PRINT"CHANGE AN ITEM, OTHERWISE ENTER THE NEW DATA.":PRINT
580 IS=AS:PRINT"ITEM DESCRIPTION: ";IS;" ?":LINEINPUT IS:
IF IS="" THEN IS=AS
590 Q=CVI(BS):PRINT"QUANTITY: ";Q:INPUT Q
600 P=CVS(CS):PRINTUSING"PRICE $$$###.##";P:PRINT" ":INPUT P
610 LS=DS:PRINT"LOCATION: ";LS;" ?":LINEINPUT LS:IF LS="" THEN
LS=DS
620 DAS=ES:PRINT"DATE: ";DAS;" ":INPUT DAS
630 LSET AS=IS:LSET BS=MKIS(Q):LSET CS=MKSS(P)
640 LSET DS=LS:LSET ES=DAS
650 PUT 1,X
660 INPUT"ANOTHER";ANS:IFLEFT$(ANS,1)="Y" THEN 500
670 GOTO 30
```

Program Listing 3

disk space; only 49 bytes are used in each 255 byte record. Also, it would be nice to be able to delete a whole record if an item was discontinued, and be able to print a sorted list of the whole inventory file.

Program Listing 5 rewrites the first module to use disk space more efficiently. With this small modification we store 245 bytes in each record (49 × 5) and waste only 10 bytes.

In line 10 we set RS to 49. This is the subrecord length. We then

divide this into 255 to see how many subrecords we can fit into a record. We use INT() because we want an integer result. In line 160 we add a second FOR loop to keep track of the number of subrecords. Note that we start the loop with zero and count to one less than the number of subrecords.

In line 170 we calculate the number of subrecords already looked at—Y (our subrecord counter) ÷ RS (the record size). We add the 1+ and put every-

```
10 CLEAR 1000: LINEINPUT "FILE NAME? ";FILES
20 OPEN "R",1,FILES
30 CLS:PRINT MENU"
40 PRINT "1: ADD ITEM"
50 PRINT "2: DISPLAY ITEM"
60 PRINT "3: CHANGE ITEM"
70 PRINT "4: FINISHED"
80 INPUT "CHOICE BY NUMBER";C:IF C<1 OR C>4 THEN 80
90 ON C GOTO 100, 300, 500, 95
95 CLOSE:END
```

Program Listing 4

```
100 RS=49: SU=INT(255/RS)
110 LINEINPUT "ITEM DESCRIPTION? ";IS
120 INPUT "QUANTITY";Q
130 INPUT "PRICE";P
140 LINEINPUT "LOCATION? ";LS
150 INPUT "DATE (01/02/88)";DAS
160 FOR X=1 TO LOP(1): FOR Y=0 TO SU-1
170 FIELD 1, (1 * RS * Y) AS Z$, 25 AS AS, 2 AS BS, 4 AS CS,
10 AS DS, 8 AS ES
180 GET 1,X
190 IF LEFT$(AS,1) = CHR$(0) THEN 230
200 NEXT Y,X: X=LOP(1)+1
210 FIELD 1,25 AS AS, 2 AS BS, 4 AS CS, 10 AS DS, 8 AS ES
220 GET 1,X
230 LSET AS=IS: LSET BS=MKIS(Q): LSET CS=MKSP(P)
240 LSET DS=LS: LSET ES=DAS
250 PUT 1,X
260 INPUT "ANOTHER";ANS: IF LEFT$(ANS,1)="Y" THEN 110
270 GOTO 30
```

Program Listing 5

```
10 CLEAR 20000: LINEINPUT "FILE NAME? ";FILES:OPEN "R",1,FILES
20 RS=49: SU=INT(255/RS): C=1: DIM DAS(LOP(1) * SU,4)
30 FOR X=1 TO LOP(1): FOR Y=0 TO SU-1
40 FIELD 1, (1 * RS * Y) AS Z$, 25 AS AS, 2 AS BS, 4 AS CS,
10 AS DS, 8 AS ES
50 GET 1,X: IF LEFT$(AS,1) = CHR$(0) THEN 80
60 DAS(C,0)=AS: DAS(C,1)=BS: DAS(C,2)=CS: DAS(C,3)=DS: DAS(C,4)=ES: C=C+1
80 NEXT Y,X: C=C-1
90 M=C: PRINT "NOW SORTING"
100 M=INT(M/2): IF M=0 THEN 260
110 J=1: K=C-M
120 I=J
130 L=I+M
140 IF DAS(I,0) < DAS(L,0) THEN 240
150 FOR X=0 TO SU-1
160 FOR Y=0 TO 2
170 A1=PEEK (VARPTR (DAS(I,X))+Y)
180 A2=PEEK (VARPTR (DAS(L,X))+Y)
190 POKE (VARPTR (DAS(I,X))+Y),A2
200 POKE (VARPTR (DAS(L,X))+Y),A1
210 NEXT Y,X
220 I=I-M: IF I<1 THEN 240
230 GOTO 130
240 J=J+1: IF J>K THEN 100
250 GOTO 120
260 PRINT "FINISHED SORT. NOW SAVING FILE IN NEW ORDER."
270 C1=1: FOR X=1 TO LOP(1): FOR Y=0 TO SU-1
280 FIELD 1, (1 * RS * Y) AS Z$, 25 AS AS, 2 AS BS, 4 AS CS,
10 AS DS, 8 AS ES
290 GET 1,X
300 IF C1>C THEN LSET AS=CHR$(0): GOTO 320
310 LSET AS=DAS(C1,0)
320 LSET BS=DAS(C1,1): LSET CS=DAS(C1,2): LSET DS=DAS(C1,3):
LSET ES=DAS(C1,4)
330 PUT 1,X: C1=C1+1
340 NEXT Y,X: CLOSE: CLEAR 1: RUN "INVENTORY"
```

Program Listing 6

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thing in parentheses to make Disk BASIC happy. If $Y=0$, we put nothing in $Z\$$ ($1 \div 49 \div 0 = 0$), then as Y advances we step through the subrecords one by one. At each step we put the subrecords we already looked at in $Z\$$, then disregard $Z\$$.

In line 200 (note the added NEXT Y) we didn't find an empty record in the file, so we increment X to the first unused record and FIELD as for the first subrecord.

In line 190 we check $A\$$ to see if the first character is a null. If it contains a valid subrecord, it would not have a $CHR\$(0)$ for the first character, because we are

LSETing the data in $A\$$. An unused subrecord would have a $CHR\$(0)$ in the beginning of $A\$$, because the disk contains $CHR\$(0)$ until you put something there.

The next task is to find a subrecord to be deleted. In this case you'd use code similar to the module beginning at line 500 (change data) to search for the item, then put a $CHR\$(0)$ in the first byte of $A\$$ when LSETing $A\$$. It will thus be considered an empty subrecord when searching for a place to put a new subrecord. You could use $MID\$(I,1,1) = CHR\(0) . Be sure to add the additional subrecord

code to all the modules; I only added it to the add data module.

To sort the data you'll have to put it into an array in memory. In this case, we'll use the array $DA\$$. To calculate the array size you'd use $DIM DA\$(LOF(1) \div SU, 4)$ after the file was opened and you calculated SU . Be sure that the program sees this DIM statement only once while the program is running or you'll get a double dimension error. Note also that this won't work if you add any records to the file after you DIM the array.

To get around these problems I'd use a separate subroutine called by the main program to

call the sort program. The sort program in turn would recall the main program when it finished: 1000 CLOSE:RUN"SORT".

The menu would call line 1000 when a sort was requested. See Program Listing 6 for the sort routine.

CLEAR 20000 in line 10 should be changed to reflect the amount of string space available after the program is loaded.

Line 300 ascertains that any unused subrecords have a $CHR\$(0)$ in their first byte to show they are unused. The CLEAR 1 in line 340 makes sure there is enough room to reload the inventory program.

The sort is a shell sort. The VARPTR routine speeds up the program. BASIC now doesn't have to do any garbage collecting as string space keeps filling up with temporary variables.

Be sure that the string space in line 10 is ample to hold the inventory for the sort. The sort only looks at the item description. To use another column make it a

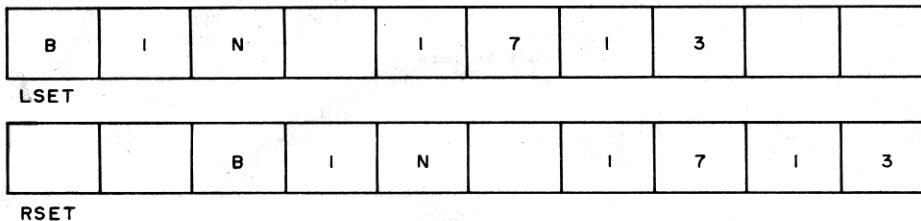
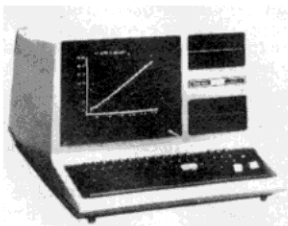


Fig. 2

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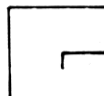
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user selected variable or change it in line 140.

This is no comparison for a machine language sort, but it hobbles along at a fair speed for a BASIC sort. The big disadvantage is that the whole thing must fit into memory. By running the sort as a separate program, we can use maximum

string space for the file. If this sort is too slow, or your RAM is not ample for the file, look into Racet's DOSORT program. This is a very fast machine language sort and does not require that the file be in RAM.

Printing

You have seen how we dis-

play the data in several of the modules. Now print the headings across the screen, and then the data, using tabs to keep the separation right. You know the lengths of the data, so this shouldn't be a problem. In the case of the price and quantity you'll have to guess at the maximum lengths.

You can use a program like this to store most any data base. My intention was only to give you a few examples of using random files to store data. I hope you give these techniques a try in your next program. They are worth studying if you are learning to use random access. ■

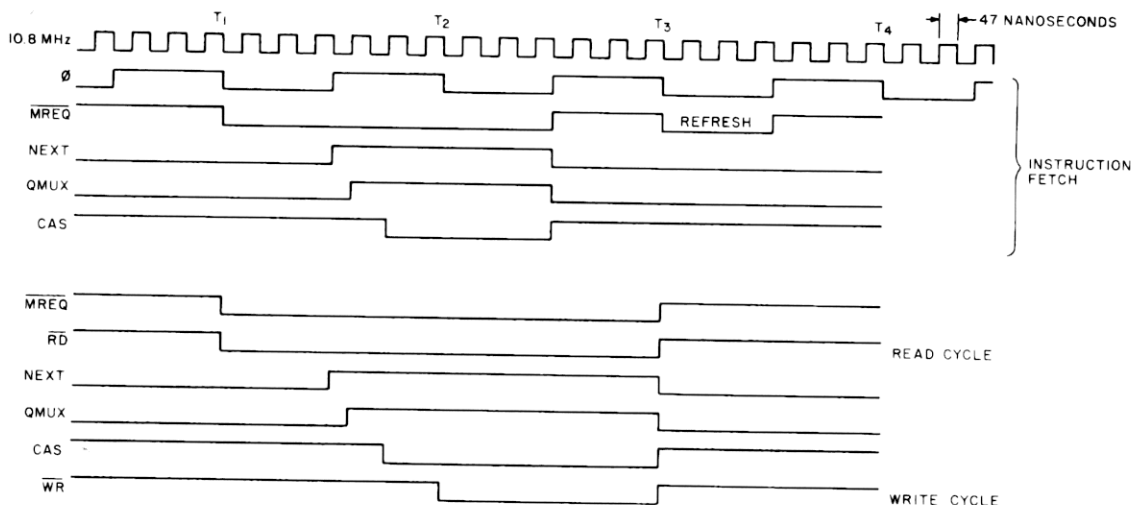


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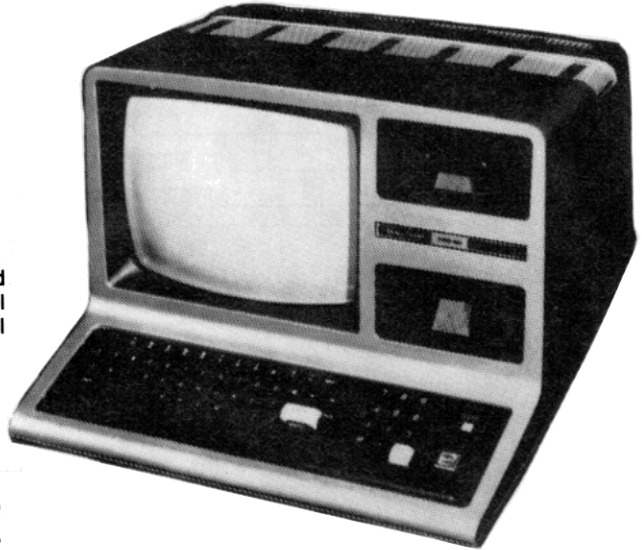
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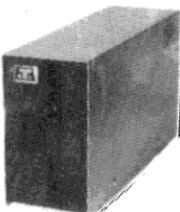
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High Speed Data Tapes

Jim Glosser
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If you've created large data files which need to be stored on tape, you know that data tapes are slow. BASIC has no choice but to use great amounts of time to load or save tapes. But there is an alternative. A machine code subroutine can reduce this time by up to 90 percent.

The Problem

BASIC has to use the PRINT #1 and INPUT #1 statements to create and read tapes. Each time the statements are used, your tape recorder turns on,

writes or reads, and turns off. This happens even in loop statements. The statement FOR X=1 TO 50:PRINT #1,A\$(X):NEXT will cause 50 ons, 50 writes and 50 offs.

Each time the tape is turned on to write, a leader of 256 zeros is written to the tape before the data.

Table 1 shows the 500 baud tape time for a string of 200 array elements averaging 50 characters each. Out of a total tape time of 16.3 minutes, only 2.7 minutes (17 percent) is actually used for the data.

Time tests on the demonstration program (Program Listing 2) resulted in a subroutine tape time of 10 seconds versus a BASIC tape time of 1 minute 55 seconds. This reduces recorder time 91 percent. The savings will vary according to the amount of ac-

tual data being saved. Time savings could never be less than 50 percent with the worst condition of 255 bytes in each string.

```
6FD0 .....
6FE0 .....BBBBBA
6FF0 AAAATEST BTEST A
```

Table 2. ASCII Dump.

The greatest time-waster in BASIC is caused by string handling. Look at the following listing, then look at the string space dump in Table 2.

```
10 CLEAR 48
20 T$ = "TEST"
30 A$ = T$ + "A":B$ = T$ + "B"
40 A$ = STRING$(5,"A"):B$ =
  STRING$(5,"B")
```

A\$ and B\$ are defined in line 30, then re-defined in line 40. But a look at the 48 bytes of string data (Table 2) shows both the original and current values of A\$ and B\$.

CLEAR 48 reserves 48 bytes of memory for string values and tells BASIC that nothing currently written there is of any value. So BASIC sets a marker to the highest address in the string space (6FFFH) and starts writing there.

The T\$ string is exactly defined in the BASIC program, so a marker (VARPTR) in another area of memory is written to point to those exact five bytes "TEST" in the program statement.

But strings A and B in lines 30 and 40 are not exactly defined. In each case, the string has to be put together in the buffer. And since the buffer doesn't exactly match a program statement, the exact string must be moved to the string space. Then the VARPTR's for A\$ and B\$ are adjusted to point to the correct number of bytes at their exact location in the string spaces. But there are two A\$s and two B\$s in the string space.

```
6FD0 .....
6FE0 .....BBBBBA
6FF0 AAAATEBBBBBAAAAA
```

Table 3. ASCII Dump.

The clear statement in line 10 says that there are no valid values stored in the string space. So when BASIC puts together string "TEST A", it writes it at the first location in the string space. Then it writes the starting location (6FFA) and the

200 Elements x 50 characters	= 10,000 bytes
200 Leaders x 256 zeros	= 51,200 bytes
10,000 bytes x 8 bits per byte	= 2.7 minutes data time
500 baud x 60 sec/min	
51,200 bytes x 8 bits per byte	= 13.6 minutes leader time
500 baud x 60 sec/min	
Total Data Tape Time	= 16.3 minutes

Table 1. String Array Tape Time.

- ARG 1 1 = Load any array but must be used to load the first array from tape. Value 1 must be used unless you know that the string space is already compressed.
- 2 = Load subsequent (2nd, 3rd, etc.) arrays. This value saves the amount of time required for a string space compression. If string variables have been created or changed since the first array load, then you must use value 1 instead.
- 3 = Write tape of string array.
- 4 = Verify the tape saved array against the values in memory.
- ARG 2 Use VARPTR to identify the array. VARPTR returns an integer value which can be used to locate the array. The array element number (0, 1, 2, etc.) must be the same number used in ARG 3. (The subroutine doesn't check this.) *Caution:* Creating additional variables after a VARPTR can cause the VARPTR value to become invalid.
- ARG 3 Starting element number of array. This identifies the first element that the subroutine is supposed to use.
- ARG 4 Last array element number to be used.

Table 4. Arguments.

length (6) in the VARPTR for A\$. "TEST B" is put in the next available space and the starting location (6FF4H) and length (6) are written in the B\$ VARPTR.

When A\$ is changed to "AAAAA", BASIC doesn't bother to see if A\$ is previously defined. (The previous definition isn't valid anymore.) BASIC just writes the new A\$ in the next available string space and writes the new location (6FEFH) and length (5) in the A\$ VARPTR.

Now the string space contains 26 bytes of memory for additional progressive writes, 10 bytes of valid data, and 12 bytes of garbage. BASIC will continue the progressive writing of strings until its need for more space will take it past location 6FDOH. At that time, it will call ROM routine 28E6H.

ROM call 28E6H reads all the string VARPTRs looking for pointers to valid data. When it finds valid data, the data is moved to the start of the string space in the same progressive manner previously seen. If we call 28E6H after line 40, the string space will be rewritten as illustrated in Table 3.

The current values of A\$ and B\$ are written in location 6FF6H through 6FFFH. No VARPTRs point to the rest of the data in the string space, and the next string will be written in the string space starting at the "E" at location 6FF5H (right over the old values).

Input from Tape

If all tape input were numeric, then BASIC could probably cope with data tapes written without

all those starts, stops and leaders. At worst, it would need a slight delay between data elements.

But input has to accept string data, also. It must be constantly ready to turn off the tape recorder to allow time for call 28E6H to compress the string space, making room for additional progressive writes.

If BASIC knew its input were the first of a series with no string writes in between, then it could call 28E6H before turning on the tape. With the string space compressed, it could handle a continuous stream of string data.

But input doesn't tell BASIC enough. So, BASIC assumes it may need to stop the tape between any two data statements.

Print statements write all those zeros so input can stop the tape after any data statement and restart it after calling 28E6H. The zeros provide the time for the tape to start and get up to speed before it reads another statement.

Those 51,200 zeros in Table 1

0	= Operation OK
-1	= Checksum error during read
-2	= Number of elements error in ARG 3 or ARG 4.
-3	= Out of string space
-4	= Invalid number in ARG 1
-5	= Array identified in ARG 2 not string or not single dimension.
+1 or higher	= Number of errors detected during verify, if any.

Table 5. Return Values.



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Program Listing 1.

00100 ;	00100	FE45 B7	01210	OR	A	; RESET CARRY
00110 ; QUICK STRING ARRAY TAPE SUB-ROUTINE	01220	FE46 E5	01230	PUSH	HL	; SAVE END OF ARRAY LOCATION
00120 ;	01240	FE47 ED42	01240	SBC	HL,BC	; IS VARPTR THIS ARRAY?
00130 ; NON-GSF INITIALIZATION	01250	FE49 E1	01250	POP	HL	; GET BACK BEFORE BRANCH
00140 ;	FE4A F253FE	FE4D 23	01260	JP	P,CHKARR	; YES-JUMP
00150 ; WRITTEN BY JIM GLOSSER	01270	FE4E E5	01270	INC	HL	; POINT TO START NEXT ARRAY
00160 ;	FE4F DDE1	FE51 18E7	01280	PUSH	HL	; PUT IN 'IX'
00170 ;	FE53 DDE5	FE55 E1	01290	POP	IX	; IS NEXT ARRAY TARGET?
00180 DEFUSR	01300	FE56 7E	01310	JR	NXTARR	; START OF TARGET ARRAY
00190 ENDMEM	01320	FE57 FE03	01320	PUSH	IX	; ARRAY TYPE
00200 ORG	01330	FE59 201D	01330	POP	HL	; IS IT A STRING ARRAY?
00210 NUMARG	01340	FE5B 110500	01340	CP	3	; NO -JUMP
00220 ARG1	01350	FE5D 201D	01350	JR	NZ,BADARR	; ADVANCE TO NUM OF DIM
00230 ARG2	01360	FE5F 19	01360	LD	DE,5	; POINT 'HL' TO NUM OF DIM
00240 ARG3	01370	FE5F 7E	01370	LD	HL,DE	; NUM OF DIMENSIONS
00250 ARG4	01380	FE60 FE01	01380	LD	A,(HL)	; IS IT SINGLE?
00260 NUMELM	01390	FE62 2014	01390	CP	1	; NO - JUMP
00270 BEGIN	01400	FE64 23	01400	JR	NZ,BADARR	; POINT TO SIZE
00280 CALL	01410	FE65 5E	01410	INC	HL	; PUT SIZE IN 'DE'
00290 PUSH	01420	FE66 23	01420	LD	E,(HL)	
00300 XOR	01430	FE67 56	01430	INC	HL	
00310 LD	01440	FE68 2AF7FD	01440	LD	D,(HL)	
00320 LD	01450	FE6B 23	01450	LD	HL,(ARG4)	
00330 LD	01460	FE6C B7	01460	INC	HL	
00340 ADD	01470	FE6D EB	01470	OR	A	
00350 ADD	01480	FE6E D52	01480	EX	DE,HL	
00360 PUSH	01490	FE70 21FEFF	01490	SBC	HL,DE	
00370 POP	01500	FE73 FA9A0A	01500	LD	HL,-2	
00380 POP	01510	FE76 1806	01510	JP	M,0A9AH	
00390 LD	01520	FE78 21FBFF	01520	JR	START	
00400 LD	01530	FE7B C39A0A	01530	JR	HL,-5	
00410 LD	01540	FE7E C57	01540	JP	0A9AH	
FE14 FE03	01550	FE80 F5	01550	LD	A,I	
FE16 280A	01560	FE81 F3	01560	LD	AF	
FE18 3C	01570	FE82 3AF1FD	01570	PUSH		
FE19 32F0FD	01580	FE85 3D	01580	DI	A,(ARG1)	
FE1C 210000	01590	FE86 2811	01590	LD	A	
FE1F C39A0A	01600	FE88 3D	01600	DEC	Z,INARLD	
FE22 AF	01610	FE89 2811	01610	DEC	Z	
FE23 32F0FD	01620	FE8B 3D	01620	DEC	Z,NXARLD	
	01630	FE8C CA48FF	01630	DEC	A	
	01640	FE8F 3D	01640	DEC	Z,TAPEWR	
	01650	FE90 CA93FF	01650	DEC	A	
	01660	FE93 21FCFF	01660	JP	Z,VERIFY	
	01670	FE96 C3F5FF	01670	LD	HL,-4	
	01680	40A7	01680	JP	RETURN	
	01690		01690	JP	RETURN	
	01700		01700	EQU	40A7H	
40FB	01710	FE99 CDE628	01710	CALL		
40FD	01720	FE9C AF	01720	INARLD		
FE26 DD2AFB40	01730	FE9D 47	01730	XOR	28B6H	
FE2A DDE5	01740	FE9E 4F	01740	XOR	A	
FE2C E1	01750	FE9F CD30FF	01750	LD	B,A	
FE2D ED4BF3FD	01760	FEA2 23	01760	LD	C,A	
FE31 B7	01770	FEA3 22F9FD	01770	CALL	CHRCNT	
FE32 ED42	01780	FEA6 2AA740	01780	LD	HL	
FE34 F278FE	01790	FEA9 DD2AF3FD	01790	LD	(NUMELM),HL	
FE37 DDE5	01800	FEAD CD1202	01800	LD	HL,(BUFFER)	
FE39 E1	01810	FEB0 CD9602	01810	LD	IX,(ARG2)	
FE3A 23	01820		01820	CALL	0212H	
FE3B 23	01830		01830	CALL	0296H	
FE3C 23	01840		01840	CALL		
FE3D 4E	01850		01850	CALL		
FE3E 23	01860		01860	CALL		
FE3F 46	01870		01870	CALL		
FE40 09	01880		01880	CALL		
FE41 ED4BF3FD	01890		01890	CALL		
	01900		01900	CALL		
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	03510		03510	CALL		
	03520		03520	CALL		
	03530		03530	CALL		
	03540					

```

;END TAPE MARK?
;YES - JUMP
;END STRING?
;YES - JUMP
;PUT CHAR IN BUFFER
;POINT NEXT BUFFER SPACE
;ADD CHAR TO CHECKSUM
;SAVE CHECKSUM
;NUM OF CHAR'S IN BUFFER
;GET NEXT CHAR
;NUM CHAR'S & CHECKSUM
;ZERO 'A'
;IS STRING COUNT 0 - NULL?
;YES - JUMP
;PTR NEXT STRING SPACE
;STRING CHAR'S IN BUFFER
;TO REG 'C'
;ZERO 'A'
;ZERO 'B'
;SWAP REGISTERS
;NEW NEXT STR SPACE
;GET BACK BEFORE BRANCH
;STRING SPACE LOWER LIMIT
;IS THERE ROOM FOR STRING?
;NO - JUMP
;SAVE CHECKSUM AGAIN
;ADDR OF BUFFER
;CHAR'S IN BUFFER
;ADJUST FOR LOCATION
;TO 'C'
;ZERO 'A'
;ZERO 'B'
;END OF STRING IN BUFFER
;RESTORE NUM OF CHAR'S CNT
;NEXT STRING SPACE
;MOVE STRING FROM BUFFER
;TO STRING SPACE
;POINT TO NEXT STRING SPACE
;GET BACK CHECKSUM
;NUM OF CHARACTERS
;VARPTR, NUM OF CHAR'S
;VARPTR, STRING ADDR
;START OF STRING
;STORE ADDR, LOW ORDER
;STORE ADDR, HIGH ORDER
;NEXT VARPTR
;ARRAY ELEMENTS TO READ
;SUBTRACT 1
;ELEMENTS LEFT TO READ
;ELEMENTS LEFT TO READ
;BLINK STAR
;ZERO 'A'
;SET CHAR COUNT = 0
;BASIC BUFFER ADDR
;START READING NEXT STRING
;READ CHECKSUM ON TAPE
;CHECKSUMS SAME?
;NO - JUMP
;NUM ELEMENTS LEFT
;IS IT ZERO?

```

Program continues

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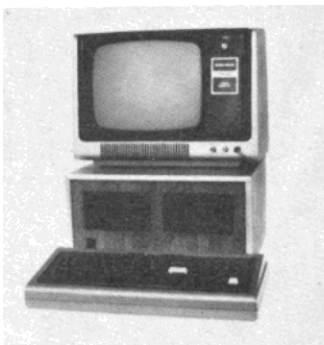
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367KB
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FF21 B5	02920	OR	L	NZ, NMELER	NO - JUMP	PP9A D5	03550	PUSH	DE	ERROR COUNT
FF22 2018	02930	JR	NZ, NMELER	HL, 0	'OK' RETURN VALUE	FF9B E5	03560	POP	HL	NUM OF ELEM TO VERIFY
FF23 210000	02940	LD	HL, 0	RETURN	RETURN VALUE	FF9C D1	03570	POP	DE	VARPTR TO FIRST ELEMENT
FF24 210000	02950	LD	HL, -1	RETURN	RETURN VALUE	FF9D DD2AF3FD	03580	LD	IX, (ARG2)	TURN TAPE RECORDER ON
FF25 210000	02960	LD	HL, -1	RETURN	RETURN VALUE	FF9E DD2AF3FD	03590	LD	0212H	FIND SYNC BYTE
FF26 210000	02970	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03600	LD	A	ZERO 'A'
FF27 210000	02980	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03610	LD	A	SET CHECKSUM = 0
FF28 210000	02990	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03620	LD	C, A	READ CHAR FROM TAPE
FF29 210000	03000	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03630	LD	FSELV	CARRIAGE RETURN?
FF30 210000	03010	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03640	LD	0235H	YES - JUMP
FF31 210000	03020	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03650	LD	0DH	GET ERROR COUNT
FF32 210000	03030	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03660	LD	0DH	ADD 1 TO IT
FF33 210000	03040	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03670	LD	0DH	STORE ERROR COUNT
FF34 210000	03050	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03680	LD	0DH	SUB 1 ELEMENTS TO VERIFY
FF35 210000	03060	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03690	LD	0DH	ANY LEFT?
FF36 210000	03070	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03700	LD	0DH	NO - JUMP
FF37 210000	03080	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03710	LD	0DH	POINT TO NEXT VARPTR
FF38 210000	03090	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03720	LD	0DH	BLINK STAR
FF39 210000	03100	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03730	LD	0DH	HOW LONG IS STRING
FF40 210000	03110	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03740	LD	0DH	IS IT NULL?
FF41 210000	03120	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03750	LD	0DH	YES - JUMP
FF42 210000	03130	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03760	LD	0DH	PUT LENGTH IN 'B'
FF43 210000	03140	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03770	LD	0DH	ADDR OF STRING \O 'HL'
FF44 210000	03150	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03780	LD	0DH	READ NEXT CHAR ON TAPE
FF45 210000	03160	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03790	LD	0DH	SAME AS CHAR IN MEMORY?
FF46 210000	03170	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03800	LD	0DH	YES - JUMP
FF47 210000	03180	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03810	LD	0DH	GET ERROR COUNT
FF48 210000	03190	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03820	LD	0DH	ADD 1
FF49 210000	03200	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03830	LD	0DH	SAVE ERROR COUNT
FF50 210000	03210	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03840	LD	0DH	ADD CHAR VALUE TO CHECKSUM
FF51 210000	03220	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03850	LD	0DH	SAVE CHECKSUM
FF52 210000	03230	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03860	LD	0DH	POINT NEXT CHAR IN MEMORY
FF53 210000	03240	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03870	LD	0DH	MORE CHAR'S IN STRING?
FF54 210000	03250	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03880	LD	0DH	YES - JUMP
FF55 210000	03260	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03890	LD	0DH	VERIFY NEXT ELEMENT
FF56 210000	03270	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03900	LD	0DH	READ NEXT BYTE FROM TAPE
FF57 210000	03280	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03910	LD	0DH	IS IT END OF TAPE MARK?
FF58 210000	03290	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03920	LD	0DH	YES - JUMP
FF59 210000	03300	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03930	LD	0DH	ADD 1 TO ERROR COUNT
FF60 210000	03310	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03940	LD	0DH	READ CHECKSUM FROM TAPE
FF61 210000	03320	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03950	LD	0DH	ARE CHECKSUM THE SAME?
FF62 210000	03330	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03960	LD	0DH	YES - JUMP
FF63 210000	03340	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03970	LD	0DH	ADD 1 TO ERROR COUNT
FF64 210000	03350	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03980	LD	0DH	GET TOTAL ERROR COUNT, 0=OK
FF65 210000	03360	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	03990	LD	0DH	TURN TAPE RECORDER OFF
FF66 210000	03370	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04000	LD	0DH	GET SAVED INTERRUPT STATUS
FF67 210000	03380	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04010	LD	0DH	JUMP IF INTERRUPTS WERE
FF68 210000	03390	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04020	LD	0DH	DISABLED UPON ENTRY INTO
FF69 210000	03400	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04030	LD	0DH	SUB-ROUTINE
FF70 210000	03410	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04040	LD	0DH	TURN ON INTERRUPTS
FF71 210000	03420	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04050	LD	0DH	RETURN TO BASIC
FF72 210000	03430	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04060	LD	0DH	JUMP TO BASIC
FF73 210000	03440	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04070	LD	0DH	
FF74 210000	03450	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04080	LD	0DH	
FF75 210000	03460	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04090	LD	0DH	
FF76 210000	03470	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04100	LD	0DH	
FF77 210000	03480	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04110	LD	0DH	
FF78 210000	03490	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04120	LD	0DH	
FF79 210000	03500	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04130	LD	0DH	
FF80 210000	03510	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04140	LD	0DH	
FF81 210000	03520	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04150	LD	0DH	
FF82 210000	03530	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04160	LD	0DH	
FF83 210000	03540	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04170	LD	0DH	
FF84 210000	03550	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04180	LD	0DH	
FF85 210000	03560	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04190	LD	0DH	
FF86 210000	03570	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04200	LD	0DH	
FF87 210000	03580	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04210	LD	0DH	
FF88 210000	03590	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04220	LD	0DH	
FF89 210000	03600	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04230	LD	0DH	
FF90 210000	03610	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04240	LD	0DH	
FF91 210000	03620	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04250	LD	0DH	
FF92 210000	03630	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04260	LD	0DH	
FF93 210000	03640	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04270	LD	0DH	
FF94 210000	03650	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04280	LD	0DH	
FF95 210000	03660	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04290	LD	0DH	
FF96 210000	03670	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04300	LD	0DH	
FF97 210000	03680	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04310	LD	0DH	
FF98 210000	03690	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04320	LD	0DH	
FF99 210000	03700	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04330	LD	0DH	
FF9A 210000	03710	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04340	LD	0DH	
FF9B 210000	03720	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04350	LD	0DH	
FF9C 210000	03730	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04360	LD	0DH	
FF9D 210000	03740	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04370	LD	0DH	
FF9E 210000	03750	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04380	LD	0DH	
FF9F 210000	03760	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04390	LD	0DH	
FF9G 210000	03770	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04400	LD	0DH	
FF9H 210000	03780	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04410	LD	0DH	
FF9I 210000	03790	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04420	LD	0DH	
FF9J 210000	03800	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04430	LD	0DH	
FF9K 210000	03810	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04440	LD	0DH	
FF9L 210000	03820	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04450	LD	0DH	
FF9M 210000	03830	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04460	LD	0DH	
FF9N 210000	03840	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04470	LD	0DH	
FF9O 210000	03850	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04480	LD	0DH	
FF9P 210000	03860	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04490	LD	0DH	
FF9Q 210000	03870	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04500	LD	0DH	
FF9R 210000	03880	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04510	LD	0DH	
FF9S 210000	03890	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04520	LD	0DH	
FF9T 210000	03900	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04530	LD	0DH	
FF9U 210000	03910	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04540	LD	0DH	
FF9V 210000	03920	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04550	LD	0DH	
FF9W 210000	03930	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04560	LD	0DH	
FF9X 210000	03940	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04570	LD	0DH	
FF9Y 210000	03950	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04580	LD	0DH	
FF9Z 210000	03960	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04590	LD	0DH	
FF9A 210000	03970	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04600	LD	0DH	
FF9B 210000	03980	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04610	LD	0DH	
FF9C 210000	03990	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04620	LD	0DH	
FF9D 210000	04000	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04630	LD	0DH	
FF9E 210000	04010	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04640	LD	0DH	
FF9F 210000	04020	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04650	LD	0DH	
FF9G 210000	04030	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04660	LD	0DH	
FF9H 210000	04040	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04670	LD	0DH	
FF9I 210000	04050	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04680	LD	0DH	
FF9J 210000	04060	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04690	LD	0DH	
FF9K 210000	04070	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04700	LD	0DH	
FF9L 210000	04080	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04710	LD	0DH	
FF9M 210000	04090	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04720	LD	0DH	
FF9N 210000	04100	LD	HL, (ARG4)	DE, (ARG3)	LAST ELEM	FF9F AF	04730	LD	0DH	
FF9O 210										

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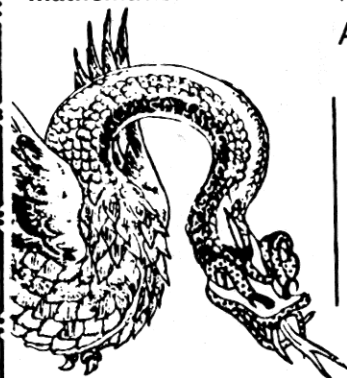
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G. Sisler	H. Wilson
S. Musial	B. Terry
T. Cobb	M. Mantle
W. Mays	H. Aaron
C. Young-P	W. Johnson-P

SUPER STAR BASEBALL Sample Lineup

D. Parker	J. Rice
W. Stargell	H. Aaron
W. Mays	L. Brock
P. Rose	R. Carew
O. Cepeda	H. Killebrew
C. Yazstremski	R. Allen
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R. Jackson	R. Zisk
G. Brett	B. Madlock
R. Guidry-P	T. Seaver-P

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In a classroom setting the instructor may elect to choose "Laws of Nature" in accordance with the complete instruction manual provided.

For insight into some of the basic principles underlying ISAAC NEWTON see *Code, Escher, Bach* by Douglas R. Hofstadter, Chapter XIX and Martin Gardner's "Mathematical Games" column in *Scientific American*, October, 1977 and June, 1959. **\$24.95**



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Machine Language Speed

We've all heard about the 4½ hour Radio Shack mailing list sort that in machine code will run in nine seconds. Machine language has to be faster! Right?

No! The BASIC Interpreter is itself a machine language program. And all identical instructions run at the same speed in the Z-80 CPU, regardless of whether they are BASIC Interpreter instructions or a subroutine.

Then why the difference between the 4½ hours and the nine seconds? Simple! The subroutine has four hours, 29 minutes and 51 seconds less

work to do.

BASIC has all kinds of conditions to consider and respond to. A machine language subroutine is written to respond to a very limited set of conditions and in a very precise manner. We won't save four hours with this one, but almost 14 minutes out of 16 ain't bad.

We will provide the subroutine exactly four instructions and then turn it loose.

•What to do (Write, Verify or Read)

•What array to use

•With which element to start

•With which element to stop

Your BASIC program gives the subroutine accurate data concerning the array and the number of elements. The array must be singly dimensioned, DIM A\$(300), and the last element must be a valid element such as 290.

DEMONSTRATION PROGRAM

```

100 CLEAR 1000:DEFINT A-Z:DIM T$(26)
110 REM DISK USERS MUST EXECUTE DEFUSR IN LINE 120 AS FOLLOWS
      16K = DEFUSR &H7DFB
      32K = DEFUSR &HBDFB
      48K = DEFUSR &HDFB
120 REM DEFUSR=&H****
130 A=0:A3=1:A4=26
140 REM BUILD TEST STRINGS
150 FOR X=1TO15:T$(X)=STRING$(5,X+64)+STR$(X)
160 FOR X1=1TO5:T$(X)=T$(X)+CHR$(X1+64):NEXT: NEXT
170 T$(16)="": REM NULL STRING
180 FOR X=17TO26:T$(X)=STRING$(10,X+64):NEXT
190 CLS:FOR X=1TO26:PRINT X;TAB(6)T$(X):FOR Y=1 TO 100:NEXT:NEXT
200 REM TEST FUNCTIONS
210 INPUT"ENTER TO CONTINUE";X
220 CLS:PRINT"1 = QUICK TAPE WRITE"
230 PRINT"2 = QUICK TAPE VERIFY"
240 PRINT"3 = QUICK TAPE READ"
250 PRINT"4 = REGULAR TAPE WRITE"
260 PRINT"5 = REGULAR TAPE READ"
270 PRINT"6 = DISPLAY TEST ARRAY"
280 INPUT"ENTER FUNCTION";X:IF X<1 OR X>6 GOTO 280
290 ON X GOTO 310, 340, 370, 410, 440, 190
300 REM QUICK TAPE WRITE
310 GOSUB 490:A=0:A1=3:GOSUB 550
320 IF A<>0 THEN GOTO 510 ELSE PRINT"QUICK WRITE DONE":GOTO 210
330 REM QUICK TAPE VERIFY
340 GOSUB 490:A=0:A1=4:GOSUB 550
350 IF A<>0 THEN GOTO 510 ELSE PRINT"VERIFY DONE":GOTO 210
360 REM QUICK TAPE READ
370 GOSUB 470:A=0:A1=1:GOSUB 550
380 IF A<>0 THEN GOTO 510 ELSE PRINT"QUICK READ DONE"
390 INPUT"ENTER TO SEE TEST ARRAY";X:GOTO 190
400 REM REGULAR TAPE WRITE
410 GOSUB 490:FOR X=1TO26:PRINT#-1,T$(X):NEXT
420 PRINT"REGULAR WRITE DONE":GOTO 210
430 REM REGULAR TAPE READ
440 GOSUB 470:FOR X=1TO26:INPUT#-1,T$(X):NEXT
450 PRINT"REGULAR READ DONE":GOTO 390
460 REM RESET ARRAY TO NULLS BEFORE READ
470 FOR X=1TO26:T$(X)="":NEXT
480 REM CHECK RECORDER
490 INPUT"ENTER WHEN RECORDER READY";X:RETURN
500 REM ERROR HANDLING
510 IF A>0 THEN PRINT"VERIFY DETECTED";A;"ERRORS":GOTO 210
520 PRINT"SUB-ROUTINE ERROR CODE ";A;"RETURNED":GOTO 210
530 REM INITIALIZATION FOR START OF USR SUB-ROUTINE
540 REM IN LINE 550, POKE VALUE '0' AS FOLLOWS:
      16K = POKE 32240,0
      32K = POKE -16912,0
      48K = POKE -528,0
550 POKE *****,0
560 REM USR SUB-ROUTINE ENTRY
570 A2=VARPTR(T$(A3))
580 A=USR(A1) OR USR(A2) OR USR(A3) OR USR(A4)
590 RETURN

```

Program Listing 2.

Arguments (Instructions)

Four specific argument values (see Table 4) are required by the subroutine. Arguments are passed to the subroutine by using a variable defined as an integer and using the OR operator to assign consecutively the four arguments to the same variable. Line 580 of the demonstration program (Listing 2) shows the preferred manner of passing argument values.

The POKE *****,0 statement in line 550 makes sure that NUMARG in Listing 1 is initialized to (0) before branching to the subroutine. The subroutine will normally re-initialize itself. However, if an error occurs in line 580, the subroutine can be looking for ARG 2,3 or 4 upon re-entry. The POKE statement ensures that the subroutine will accept the arguments in their proper order.

Note the caution concerning ARG 2 (Table 4). Creating additional simple variables will cause array VARPTR's to be relocated. To prevent that, A2=VARPTR(T\$(A3)): is the last variable defined before going to the subroutine transfer line (Listing 2, line 570). Variable A is also defined before A2 for the same reason. (See Listing 2, line 130.)

I use a single, long array string for each complete data record and I extract individual fields with the MID\$ function. Numeric values are included with the string data by using the STR\$(X) function. X=VAL(MID\$(Y(N),P,L) extracts the numeric data.

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170- 180 DEFUSR points BASIC to machine language subroutine.
 270- 490 BEGIN accepts the arguments (instructions) from BASIC and stores them for program use. It keeps returning to BASIC until has all four arguments.
 1000-1530 CHECK looks at the array to make sure that it's a string array and that it is sized as large or larger than the last element number to be used.
 2000-2130 START determines the operation needed and proceeds to read, verify or write routines.
 2160- INARLD compresses the string space.
 2170-2270 NXARLD sets pointers to accept a new array and turns on the tape recorder.
 2280-2390 NXBYRD reads characters from the tape until a carriage return (OD) or end of tape mark (OF) is read. Characters are stored in a buffer and character value is added to a checksum.
 2400-2860 STRSTR checks for enough string space to store the string, then moves it from the buffer to the string space and writes the location and length in VARPTR. It initializes for the next string and returns to NXBYRD.
 2870-3080 ENDRD reads the checksum from tape and compares it with the checksum calculated in NXBYRD.
 3100-3190 TAPEWR initializes for tape writing and turns on the tape recorder.
 3200-3280 NXELWR writes the CR (OD) after a string and checks to see if more strings need to be written to tape.
 3290-3420 FSELWR writes the string characters to the tape and adds the character value to the checksum.
 3430-3480 ENDWR writes the end of tape mark (OF) and the checksum to tape.
 3500-3630 VERIFY initializes for verification and turns on tape recorder.
 3640-3690 NXELVF checks for CR (OD) after each string.
 3700-3830 CROK checks for more array elements to verify and sets pointer to next.
 3840-3890 NXBYVF compares character read from tape and character in memory and increments error count if not same.
 3900-3950 BYOK adds character value to checksum and checks for end of string.
 3960-4010 ENDVER verifies end of tape mark.
 4020-4080 ENTPOK reads checksum from tape and compares with calculated checksum.
 4090-4150 RETURN turns on interrupts, turns off tape and goes back to BASIC with return value in HL.

Program Summary

When the subroutine passes control back to BASIC, it returns a value in HL. This value is assigned by BASIC to the variable used at the beginning of the USR branch line in the demonstration listing. Reading the variable after control returns to BASIC, will tell you the results of the subroutine's operation.

Return values are listed in Table 5. Those values are demonstrated in Listing 2. Table 6 should give you some hints about array storage. This should help you with modifications.

Using the Subroutine

To assemble the subroutine set memory size to 32240, 48624 or 65008 for 16, 32 or 48K respectively. Load the program from tape with the System command. After the program loads, answer the second prompt with / Enter. Your BASIC program is now ready to load.

Loading in Disk BASIC destroys the USR link address at 408EH, so it must be re-established with the DEFUSR instruction as demonstrated in line 120 of Listing 2.■

BASIC PROGRAM TO CREATE ARRAYS.

```
10 DIM AA%(3) 'CREATE INTEGER ARRAY
20 DIM BB!(3) 'CREATE SINGLE PRECISION ARRAY
30 DIM CC$(3) 'CREATE DOUBLE PRECISION ARRAY
40 DIM DD$(3) 'CREATE STRING ARRAY
50 DIM E$(2,2) 'CREATE 2 DIMENSION ARRAY
60 END
```

THE POINTER TO THE START OF ARRAYS IS AT LOCATION 40FBH.

57A0H

40FB A0 57 29 58 BF 56 04 04 04 04 04 04 04 04 04

THE POINTER TO THE START OF FREE SPACE (FOLLOWING ARRAYS) IS AT LOCATION 40FDH.

5829H

40FD 29 58 BF 56 04 04 04 04 04 04 04 04 04 04 04

DUMP OF ARRAY STORAGE SPACE (57A0H to 5829H).

#	%	&	*	\$1	(0)	(1)	(2)	(3)
57A0	02 41 41 0B 00 01 04 00	00 00 00 00 00 00 00 00						
	4 B B	19 1	4	(0)	(1)			
57B0	04 42 42 13 00 01 04 00	00 00 00 00 00 00 00 00						
	(2)	(3)	8 C C	35 1	4			
57C0	00 00 00 00 00 00 00 00	08 43 43 23 00 01 04 00						
	(0)	(1)						
57D0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00						
	(2)	(2)						
57E0	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00						
	3 D D	15 1	4	(0)	(1)	(2)		
57F0	03 44 44 0F 00 01 04 00	00 00 00 00 00 00 00 00						
	(3)	3 E	32 2	3	3	(0,0)		
5800	00 00 00 00 03 00 45 20	00 02 03 00 03 00 00 00						
	(1,0)	(2,0)	(0,1)	(1,1)	(2,1)			
5810	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00						
	(0,2)	(1,2)	(2,2)	START OF FREE SPACE				
5820	00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00						

KEYS

#=Array Type

2=Integer

3=String

4=Single Precision

8=Double Precision

%=Array Name

&=Number of bytes from this location to last byte of array.

*=Number of dimensions

\$1=Size-1st dimension

\$2=Size-2nd dimension, etc.

(n)=Array element

NOTE: Number of bytes per array element is equal to array type.

String array elements consist of VARPTR which gives size and starting location of string.

Table 6. This is a detail of the BASIC array storage arrangement.

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The Real Rules of 78s

R. L. Conhaim
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No one wants to pay any more than necessary, with the high cost of borrowing money these days. But, few people realize that early payoff can save something from the interest portion of a loan. The question is, how much can you save?

There's a formula that many banks and loan companies use called The Rule of 78's. It gets its name from the fact that the numerical value of the months in a year, when added together, total 78. That is, $1 + 2 + 3 + \dots + 12 = 78$. The formula used to determine the rebate is:

$$\text{Rebate} = \frac{(n - k + 1)(n - k)}{n^2 + n} \times \text{FC}$$

where n = total number of payments in the contract, k = the number of payment periods already passed at early payoff, and FC = the total finance charge (interest) in the original loan.

Take the case of a person with an original contract of 36 months which has a total interest of \$467.24. How much could he save if he paid off at the 15th month? Plug the numbers into

the formula and out comes \$162.06 or almost 35 percent of the original finance charge.

A pocket calculator with square root capability could give you the answer to the problem. But, suppose you'd like to see how much could be saved at the 16th, 17th and all subsequent months? That's where your computer outshines the laborious calculator method. With a simple program like that shown in Listing 1, you can print out all the answers in just a couple of seconds.

The program is short and straightforward. You just enter the three variables which are printed out for recordkeeping purposes. If you don't need a printout, change the LPRINT's in lines 60, 70, 80, 130 and 140 to PRINT commands.

The variable X is used to stop the program for every 12 output lines so the answers won't scroll off the screen. Typing CONT restarts the printout where it left off. Line 120 stops the execution of the program when the payoff month equals the number of months in the contract.

The left bracket symbol (()) in line 100 is the exponentiation sign, and in many computers and printers is shown as an up arrow (^). ■

```
10 REM "RULE OF 78 REBATE CALCULATION"
20 CLS:INPUT "ENTER TOTAL FINANCE CHARGE";FC
30 INPUT "ENTER TOTAL NUMBER OF MONTHS IN CONTRACT";N
40 INPUT "ENTER NUMBER OF PAY-OFF MONTH";K
50 CLS:LPRINT "TOTAL FINANCE CHARGE = ";FC
60 LPRINT "TOTAL MONTHS IN CONTRACT ";N
70 LPRINT "FIRST PAY-OFF MONTH ";K
80 LPRINT TAB(10); "PAY-OFF MONTH          REBATE"
90 X=0
100 RB= (((N-K+1)*(N-K))/(N*(2+N)))*FC
120 IF K=N GOTO 200
130 LPRINT TAB(15);K;
140 LPRINT USING "          ##,###.##";RB
150 X=X+1
160 IF X=12 GOTO 180 ELSE 170
170 K=K+1:GOTO 100
180 X=0 :STOP
190 GOTO 170
200 END
```

Program Listing 1

TOTAL FINANCE CHARGE = 467.24		
TOTAL MONTHS IN CONTRACT 36		
FIRST PAY-OFF MONTH 15		
PAY-OFF MONTH	REBATE	
15	162.06	
16	147.33	
17	133.30	
18	119.97	
19	107.34	
20	95.41	
21	84.19	
22	73.66	
23	63.84	
24	54.72	
25	46.30	
26	38.59	
27	31.57	
28	25.26	
29	19.64	
30	14.73	
31	10.52	
32	7.02	
33	4.21	
34	2.10	
35	0.70	

Sample Problem

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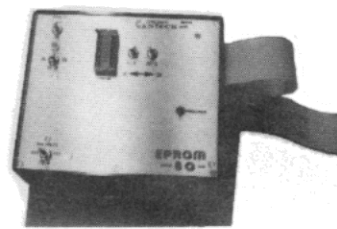
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```
10 ON ERROR GOTO 30000
30000 IF ERR/2 + 1 = 11 THEN RESUME NEXT
30010 PRINT "ERROR NUMBER ";ERR/2 + 1;" IN LINE ";
    ERL
30020 INPUT "PRESS ENTER TO CONTINUE";Z$:RESUME
    10
```

When the TRS-80 discovers an error, it shifts to either command or edit mode. This seems perfectly sensible: If the machine cannot do what you have asked it to, or, if continued execution will produce nothing but garbage, the best thing is to stop. Stopping execution poses no problem *unless* you have non-program data stored in memory. In this case, there is no way to restart without losing the stored data.

Level II BASIC incorporates a short set of statements that set up an error trapping routine. These routines deal with errors in two ways. One handles loss of data. Another allows the computer to ignore an error of little consequence that occurs in a program so that execution can continue. For example, if I were taking logarithms from numbers generated internally and there was a chance a negative number could pop up, I might want to simply skip that number and go on.

Record Student Grades

I use a homemade program to record my students' grades. During the course of the program, individual test grades are used as divisors. When a student is absent for a test, a zero is entered until he takes a make-up, at which time the program changes the grade. Since zero cannot be used as a divisor, a potential exists for a division by zero error. As the program is tight on RAM space, I did not want to add another module to deal with this eventuality.

The error trapping routine below was developed to handle this problem. Its structure illustrates how such routines work.

The ON ERROR GOTO instruction in line 10 initiates the routine, substantially altering the way in which errors are processed. When an error is discovered, execution doesn't shift to command or edit mode, but proceeds to the indicated line number for further instructions. This process works much like a subroutine, and the instruction, like GOSUB, works as a paired instruction. When the routine has finished, a RESUME is necessary. Obviously, this instruction must be read *before* an error occurs and should be placed at the beginning of the program.

The routine could be terminated at this point by adding the line: 30000 RESUME NEXT. This would cause the computer to ignore the error and branch back to the next program statement to continue execution. In my grade program, this is what I wanted if the error was an attempt at division by zero. But, if it was some other error that materially altered program output, that error would also be ignored.

The 80 reports errors using abbreviations; these codes appear on pages B/2 and B/3 of the manual. Computers deal with everything as numbers, however, and their conversion into letters is for human convenience. The error condition is carried internally as a number, which can be used in error trapping to designate specific errors. The instruction ERR/2 + 1 in lines 30000 and 30010 is for this purpose. Entering PRINT ERR/2 + 1 after an error occurs will return a number which identifies the error. The number codes for errors appear on page B/1 of the manual.

In my grade program, the error I want ignored is division by zero, error code 11. Line 30000 means, "If the error you have found is division by zero, forget it and pick up execution on the line or statement following the error. If it is not, then drop to line 30010."

PRINT ERL returns the line number in which the error happened. Line 30010 tells us what and where the error is, and line 30020 stops execution so we can make some decisions. Possibly the error involves inoperable data, such as trying to take the square root of a negative number. In this case, we just want to go back to make another data entry. On the other hand, if the error is one that needs fixing, we are going to have to leave the execute mode for repairs.

Dumping Data

After adding, deleting or editing lines, we cannot continue execution and running the program will cause data loss. If there is considerable data involved, a module can be built into the error trapping routine itself to dump data to tape before you hit the break key. This makes a matching loading routine necessary.

There are defaults for the ERL instruction: If no error has been made, it returns a zero; if the error was made in direct mode, such as trying to use INPUT in command mode, the number 65535 will be returned.

The RESUME statement is similar to RETURN; its action is similar, but options are available which enhance its effect. Used alone, as RESUME 0, it will return to the statement in which the error was committed. Run these lines:

```
10 FOR X = -10 TO 10
20 PRINT SQR(X)
30 NEXT:END
```

Since we cannot take square roots of nega-

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tive numbers, an FC message is returned.
Now add these lines:

```
5 ON ERROR GOTO 100
100 X = X + 1:RESUME (or RESUME 0)
```

The trapping routine lets us increment X until the data becomes operable.

A line number may also be specified for the return point. The following lines illustrate this:

```
5 ON ERROR GOTO 100
10 FOR Y = 1 TO 25
20 X = RND(20) - 10
30 PRINT X,SQR(X)
40 NEXT
100 RESUME 500
500 X = -X:PRINT SQR(X);"!"
510 NEXT
```

Although square roots of negative numbers cannot be expressed as real values, they may be represented as complex numbers after the real and imaginary parts are computed. When a negative number is processed, an FC error will result, which sends execution to line 100. The RESUME 500 in that line further branches to the indicated line number for complex number computation and printout, after which we are returned to the loop in line 10. In this case the routine is acting much like a flag which detects and processes negative numbers.

RESUME NEXT returns to the statement following that in which the error was made. This is useful if we want to ignore all negative numbers in a square root program. In my grading program, this is what I wanted. Using the ON ERROR GOTO instruction is like flipping a light switch—it will stay on until we turn it off. It may be that we want this routine to operate in one part of a program, but not in another. In that case, the error trapping process is disabled by the instruction ON ERROR GOTO 0. The function can now be turned on and off at will.

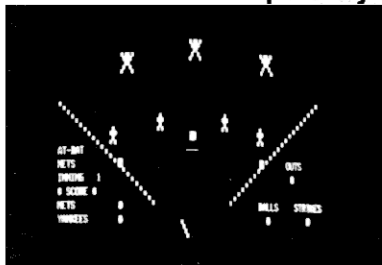
The error trapping routine discussed here is a simple one. Error trapping routines can be built to do some remarkable tasks. These routines are more complex to construct and should be tested to see that they are working properly. An additional instruction, ERROR n, is provided for that use. Look at the following lines:

```
5 ON ERROR GOTO 1000
10 ERROR 8
20 .....
```

Line 10 causes the computer to behave exactly as it would if an undefined line error had been found. Any of the recognized errors can be simulated by using the number code for that error. In this way, routines can be checked for proper operation.

Error trapping routines are very useful in debugging programs. Using the ON ERROR GOTO nnn instruction as line 1, and a suitable routine at line 30000, the program can be cleaned up and these lines deleted after corrections are made. We've come a long way from Level I's WHAT, HOW and SORRY! ■

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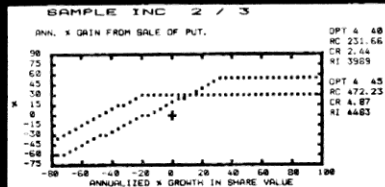
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A Quick Riff on Synthesizers

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Do you remember what occupied your spare time before you bought your computer? Was it ham radio? Stamp collecting? Model railroading?

We played music. We used the big ARPs and Moog synthesizers for live performing and recording. That old flame was ignited again with the recent appearance of several music synthesizers for the TRS-80.

Tone generation is not too difficult on the '80. Many of the games on the market utilize the notes and sound effects created by toggling flip flops at the cassette port.

But music is more than a sequence of notes. It requires polyphonic voices, that is, many notes played simultaneously; oscillator waveform selection (square, sine, sawtooth, triangle, pulse); dynamic control of the composite waveform's harmonics; most important, a low pass filter with variable cut-off frequency (and preferably variable Q or resonance); and a volume control.

Such bare bones features are found on even the cheapest piano keyboard style

electronic synthesizers.

ARPS and Moogs

Let's briefly examine how sounds are created on performance synthesizers.

In 1964, Robert Moog produced a system of dc voltages that controlled various parameters such as frequency, filtering and volume.

A piano style keyboard, set up to output dc voltages in relation to each key, connects to one or more oscillators. These VCOs (voltage controlled oscillators), are capable of producing several waveforms. Each shape is made up of different overtones (see Fig. 1). It is important to be able to select these shapes as they determine the resulting sound.

A sine wave is a pure tone with no overtones. Square waves have a hollow sound. Squeeze the sides of a square wave together and you get a pulse waveform. This reedy, nasal tone is useful in duplicating saxophone sounds. Violins and brass effects can be simulated by first starting with a sawtooth.

Most manufacturers use oscillators which respond to one volt per octave. If, for example, an oscillator played a middle C, then raising its input to two volts would produce a C one octave higher. You can see the precision needed in designing oscillator controllers. If the voltage is off by as little as

one-twelfth volt, you're playing in another key!

Random noise generators, creating white, pink or low frequency sounds, are also used to effect explosions, surf, wind, earthquakes, as well as percussion instruments.

As shown in Fig. 3, output from various sources are mixed into one composite signal as they move down to their next modifiers, the VCF, (voltage controlled filter), and then to the VCA (voltage controlled amplifier).

Envelope generators monitor these latter two devices. They create a slowly varying dc voltage that controls the cut-off frequency of the filter and the attenuation (volume) of the amplifier.

When the musician hits a key, three things happen. A dc voltage is produced to feed the oscillators; a gate pulse is created for as long as the key is depressed (typically zero volts when no key is held down, 10 volts when one is); and a trigger pulse, or short spike of voltage, is produced when the key is initially depressed. The gate and trigger pulses are used to tell the envelope generators to start their pre-programmed voltage patterns.

Take a look at the graphic representation

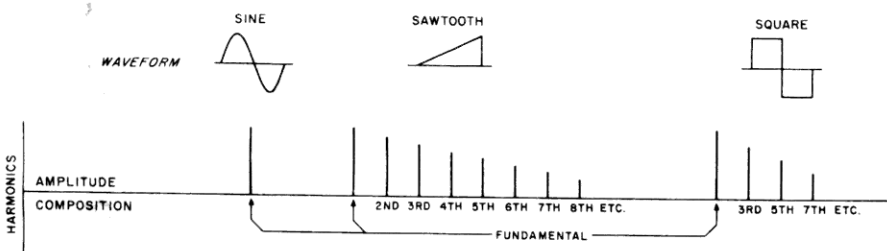


Fig. 1. Waveforms and Their Composition

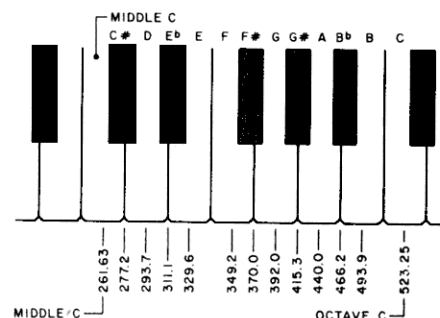


Fig. 2. The Frequencies of the 12-Note Octave Standard

"An envelope with a fast attack time and slow release time would be used to control the amplifier."

of the sound of a piano note being struck (Fig. 4). First, the sound is loud and then gradually gets softer. Here, an envelope with a fast attack time and slow release time would be used to control the amplifier. Also, as the sound diminishes, the higher harmonics are lost. Therefore, another gen-

erator is employed to control the filter.

From here the signal goes to the amplifier, speakers and then to you. Of course, you could alter the signal in other monstrous ways: ring modulation, reverb, echo, phase shifting, waveform inverting, phase locked loops... HELP!

Now that you know a little about the creation and modification of sound you are in a better position to choose the computer synthesizer that will best meet your expectations. ■

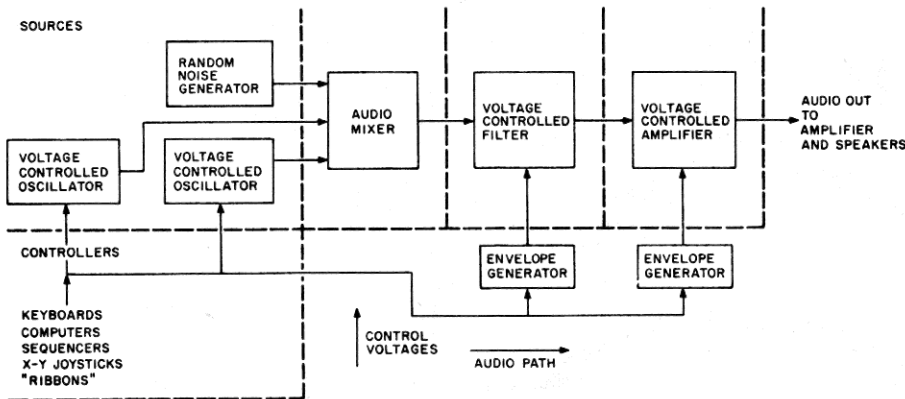


Fig. 3. Signal Flow and Control Layout of Performance Synthesizer

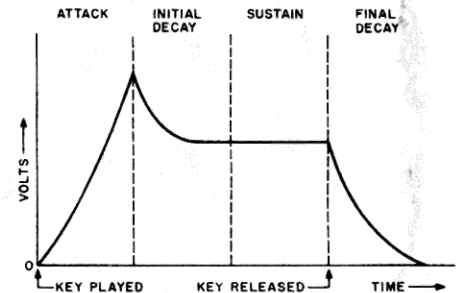


Fig. 4. Envelope Generator Parameters: On a typical keyboard synthesizer, voltage is developed by the envelope generator when a key is played. Voltage rises to a level pre-set by a potentiometer, then falls to a level determined by another potentiometer and stays there until the key is released. Upon release, the voltage falls to zero at a rate determined by a fourth control.

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Undocumented Instructions

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put in front of the load instruction, then the contents of the high-order byte of the IX index register are moved into the A register:

```
DEFB 0DDH ;gives key to IX register
LD  A,H ;moves high byte of IX into A
```

If a hex FD is used in place of the DD, then the high-order byte of the IY register would be moved into the A register. In order to reference the low-order byte of the index registers, use instructions that normally refer to the L register. In an example the load instruction would read, LD A,L.

You can load into (and from) both index registers as well as the general registers A, B, C, D, and E. The HL register pair cannot be used since they now refer to the index registers. If the following instructions were executed—DEFB 0FDH LD H,L—they would result in the lower half of the IY register moving into the upper part of the same register.

The load immediate instructions also works on these registers. For example, DEFB 0DDH LD H,2 will load the number two into the high order byte of the IX register. Add, and add with

carry, and subtract, and subtract with borrow instructions can be performed between the high and low bytes of the index registers and the data in the accumulator. It is also possible to increment, decrement, compare, AND, OR, and EXOR between the accumulator and index registers.

Another instruction on the general purpose registers, including the H and L registers, will take the contents of the register, multiply by two and add one ($r = r \times 2 + 1$). I called this DUPINC in the table. This requires two bytes. The first contains the hexadecimal value CB. The second contains the register the operation is carried out on.

In Table 1 HX and LX are used as names for the high-order and low-order bytes of the IX register. I use HY and LY for the IY register. The lowercase n, used in the immediate type instructions, is the symbol for a number.

By using these undocumented instructions, not only do you free up extra registers for general work, but a certain amount of protection is added to the security of your programs. Most disassemblers and monitors do not support these extra instructions

and will display what appears as data areas right in the middle of your programs. ■

*Editor's Note: These opcodes are not tested during production of the Z80 chip by Zilog. It is possible, in a small number of cases, that any of these opcodes may not work.

Table 1.

MNEMONIC		OP CODE
LD	HX,A	DD67
LD	HX,B	DD60
LD	HX,C	DD61
LD	HX,D	DD62
LD	HX,E	DD63
LD	LX,A	DD6F
LD	LX,B	DD68
LD	LX,C	DD69
LD	LX,D	DD6A
LD	LX,E	DD6B
LD	HY,A	FD67
LD	HY,B	FD60
LD	HY,C	FD61
LD	HY,D	FD62
LD	HY,E	FD63
LD	LY,A	FD6F
LD	LY,B	FD68
LD	LY,C	FD69
LD	LY,D	FD6A
LD	LY,E	FD6B
LD	HX,n	DD26
LD	LX,n	DD2E
LD	HY,n	FD26
LD	LY,n	FD2E
ADD	A,HX	DD84

Table continues

Have you ever needed an extra general purpose register? And wouldn't it be great to be able to split those, sometimes unused, 16-bit index registers in half and get four more eight-bit work registers? Well, it can be done—if you know how to access them.

The key to these new registers and their instructions, is to precede an H or L type instruction with a special hex code. A hex code of DD tells the CPU that you are going to use the IX registers and a code of FD tells it you're using the IY index register.

Let's look at an example of how this is done. Normally the LD A,H (hex 7C) will move the contents of the H register into the A register. But if a hex DD is

ADD A,LX DD85
ADD A,HY FD84
ADD A,LY FD85

SUB A,HX DD94
SUB A,LX DD95
SUB A,HY FD94
SUB A,LY FD95

INC HX DD24
INC LX DD2C
INC HY FD24
INC LY FD2C

AND HX DDA4
AND LX DDA5
AND HY FDA4
AND LY FDA5

XOR HX DDAC
XOR LX DDAD
XOR HY FDAC
XOR LY FDAD

DUPINC A CB37
DUPINC B CB30
DUPINC C CB31
DUPINC D CB32
DUPINC E CB33
DUPINC H CB34
DUPINC L CB35
DUPINC (HL) CB36

LD A,HX DD7C
LD B,HX DD44
LD C,HX DD4C
LD D,HX DD54
LD E,HX DD5C

LD A,LX DD7D
LD B,LX DD45
LD C,LX DD4D
LD D,LX DD55
LD E,LX DD5D

LD A,HY FD7C
LD B,HY FD44
LD C,HY FD4C
LD D,HY FD54
LD E,HY FD5C

LD A,LY FD7D
LD B,LY FD45
LD C,LY FD4D
LD D,LY FD55
LD E,LY FD5D

LD HX,LX DD65
LD LX,HX DD6C
LD HY,LY FD65
LD LY,HY FD6C

ADC A,HX DD8C
ADC A,LX DD8D
ADC A,HY FD8C
ADC A,LY FD8D

SBC A,HX DD9C
SBC A,LX DD9D
SBC A,HY FD9C
SBC A,LY FD9D

DEC HX DD25
DEC LX DD2D
DEC HY FD25
DEC LY FD2D

OR HX DDB4
OR LX DDB5
OR HY FDB4
OR LY FDB5

CP HX DDBC
CP LX DDBD
CP HY FDBC
CP LY FDBD

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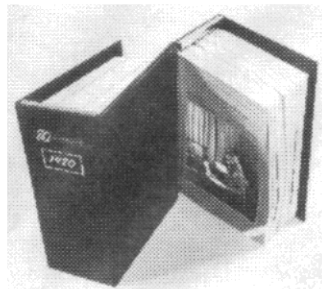
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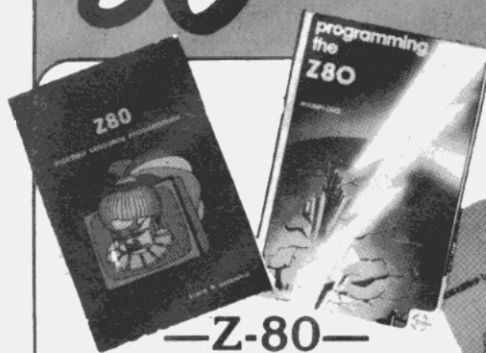
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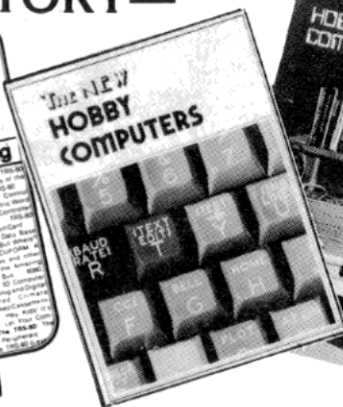
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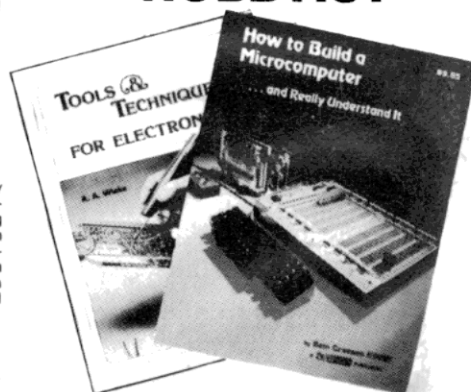
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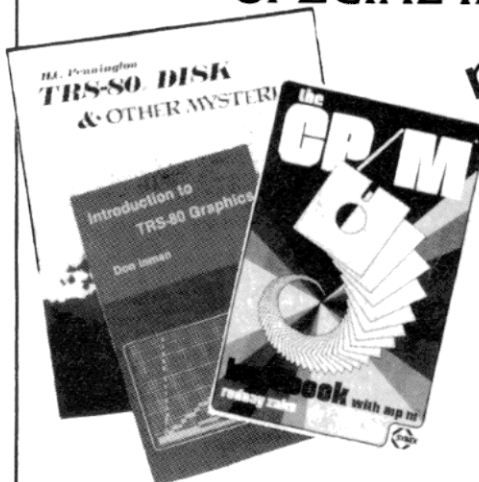
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	IBM Compatible (128 B/S, 26 sectors) w/ W.P.N. & Hub ring	3092	2.24	—	—	—	—	—	—	—	—	—	740-0	—	—	—	—	—	—	
	IBM Compatible (128 B/S, 26 sectors) REVERSIBLE	3094	2.55	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Single-Headed Drives	1729	3.35	MF-113110	473072	54431	—	—	—	40015	—	FD-2	740-2-0	—	15150	FD34-2000	F171111X	7880-K	—	
	Single-Density Media	3098	2.19	—	473077	54581	—	800509	1899959	40014	—	—	740-0 086	—	15003	FD80-1000	F181111X	—	—	
	IBM System 6 Compatible	3108	2.19	MF-111210	473073	—	—	800584	2305845	40040	—	—	740-3600	—	15005	FD96-1000	F191111X	7881-K	—	
	IBM Compatible (128 B/S, 8 sectors)	3110	2.19	—	473074	—	—	800585	1899954	40044	—	—	—	—	15004	FD96-1000	F191111X	7880-K	—	
	Shugart Compatible, 32 hard sector	3015	2.19	MF-211010	470801	53802	CM-F21	10111	—	40018	—	—	740-2-32	—	15151	FD32-2000	F231111X	7880-K	421322	
	Shugart Compatible, 32 hard sector REVERSIBLE	3075	3.35	MF-213010	—	—	—	—	—	40017	—	—	740-2-32	—	—	—	—	—	—	
	Wang Compatible, 32 hard sector w/Hub ring	3087	2.50	—	—	54401	—	—	—	—	—	—	740-32RM	—	—	—	F37A411X	—	—	
Flexible Disc 1d	IBM Compatible (128 B/S, 26 sectors)	3090	2.95	MF-121010	474071	54568	—	37401D	—	40047	FD1-126/M2100	FD-1D	741-0	—	—	FD34-8000	F131111X	7887-K	423002	
	IBM Compatible (128 B/S, 26 sectors) REVERSIBLE	3092	3.99	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Shugart Compatible, 32 hard sector	3091	2.95	MF-221010	470801	54596	—	10111D	—	40024	—	—	741-32	S/A-103	15075	FD32-8000	F33A410X	7887-K	423322	
	Shugart Compatible, 32 hard sector REVERSIBLE	3094	3.99	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Wang Compatible, 32 hard sector w/Hub ring	3098	3.20	—	—	—	—	—	—	—	—	—	—	—	—	—	F22A411X	—	—	
	Double-Headed Drives	3101	3.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Double-Density Media	3113	3.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (Unformatted)	3113	3.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (128 B/S, 26 sectors)	3108	3.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	32 Hard Sector	3108	3.84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Flexible Disc 3a	Soft Sector (Unformatted)	3102	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (128 B/S, 26 sectors)	3115	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (256 B/S, 26 sectors)	3103	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Double-Headed Drives	3114	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Double-Density Media	3114	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (512 B/S, 16 sectors)	3104	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (1024 B/S, 8 sectors)	3106	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	32 Hard Sector	3106	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Burroughs 8-80 Compatible 32 Hard Sector	3092	3.49	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Soft Sector (1024 B/S, 8 sectors) w/ Hub Ring	3116	3.75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
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	10 Hard Sector w/Hub Ring	3433	2.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
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	Soft Sector	3421	2.74	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
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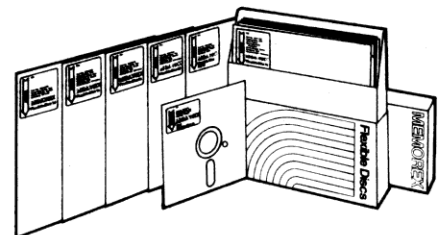
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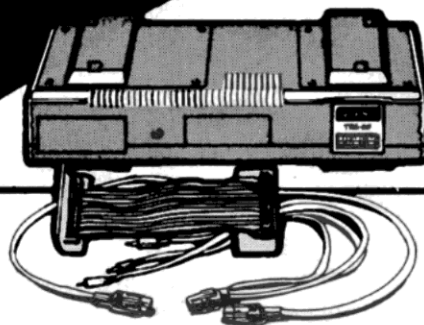
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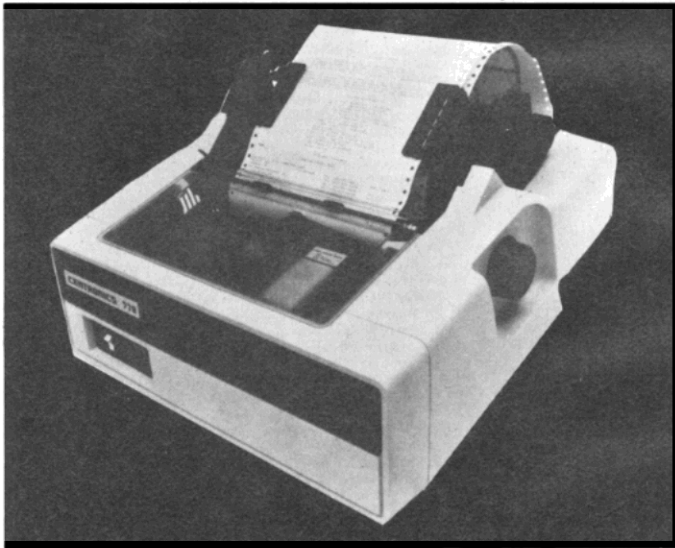
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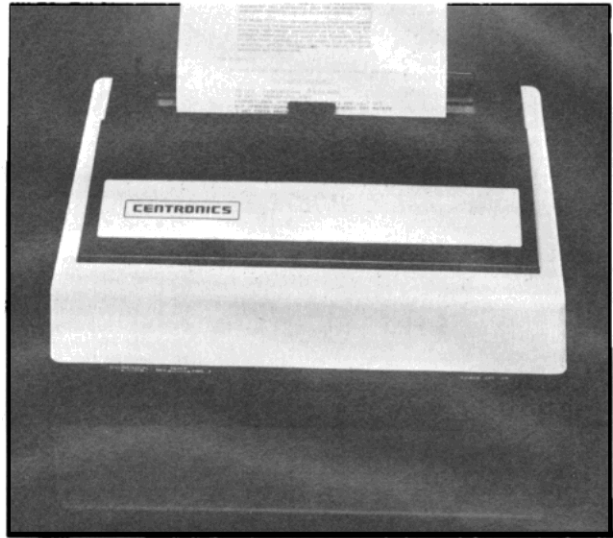
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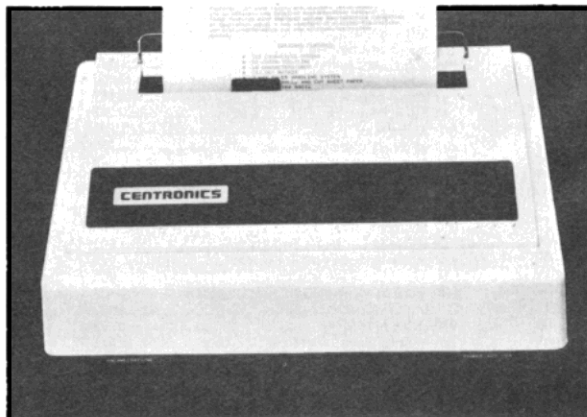
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III. What are your primary applications of your TRS-80 (check only two)?

- ☐ A. Business
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☐ E. Scientific
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IV. Your TRS-80, is it a

- ☐ 1. Level I
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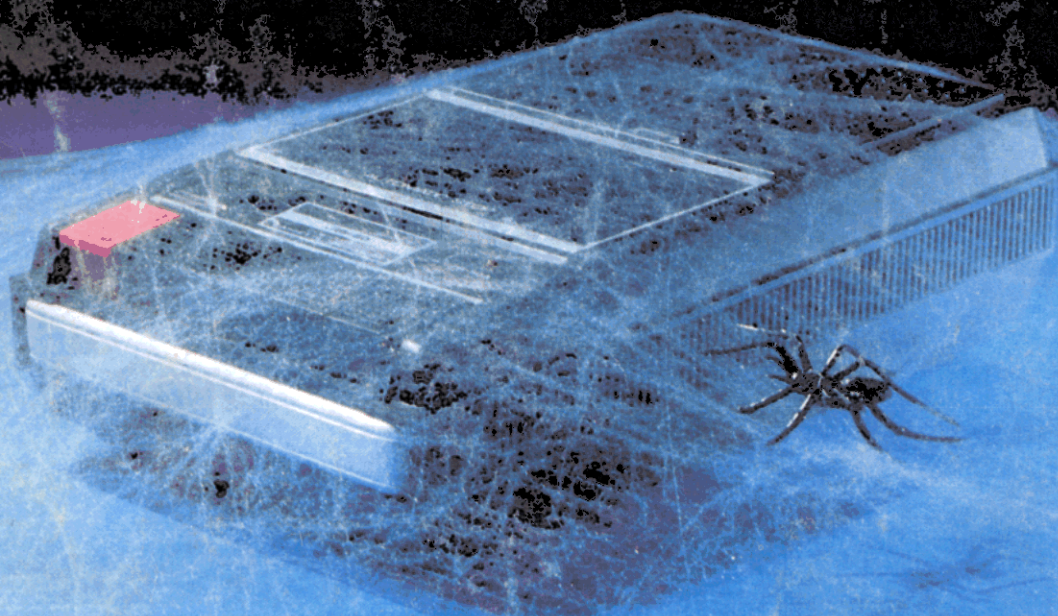


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Several versions of the ESF are available, for the *TRS-80*, *Apple*, *PET*, *OSI* and an *RS 232* unit. Even the slowest of the units is 15 times faster than a cassette, and all are as reliable as disk drives - in fact a lot of users say they are *more* reliable!



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To get further information about the ESF give Exatron a call on their Hot Line 800-538 8559 (inside California 408-737 7111).

If you can't wait any longer then take advantage of their 30 day money-back guarantee, you've nothing to lose but time!

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